

Fig 1

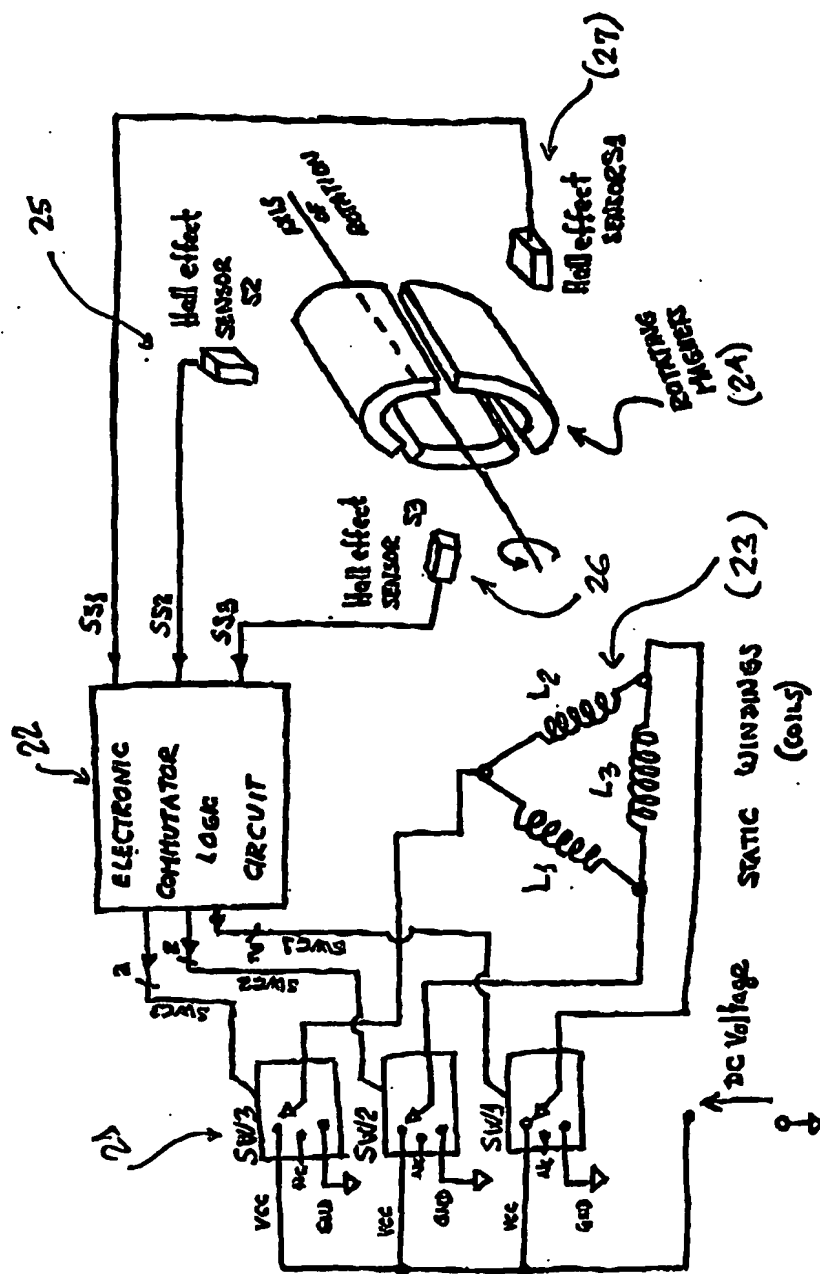
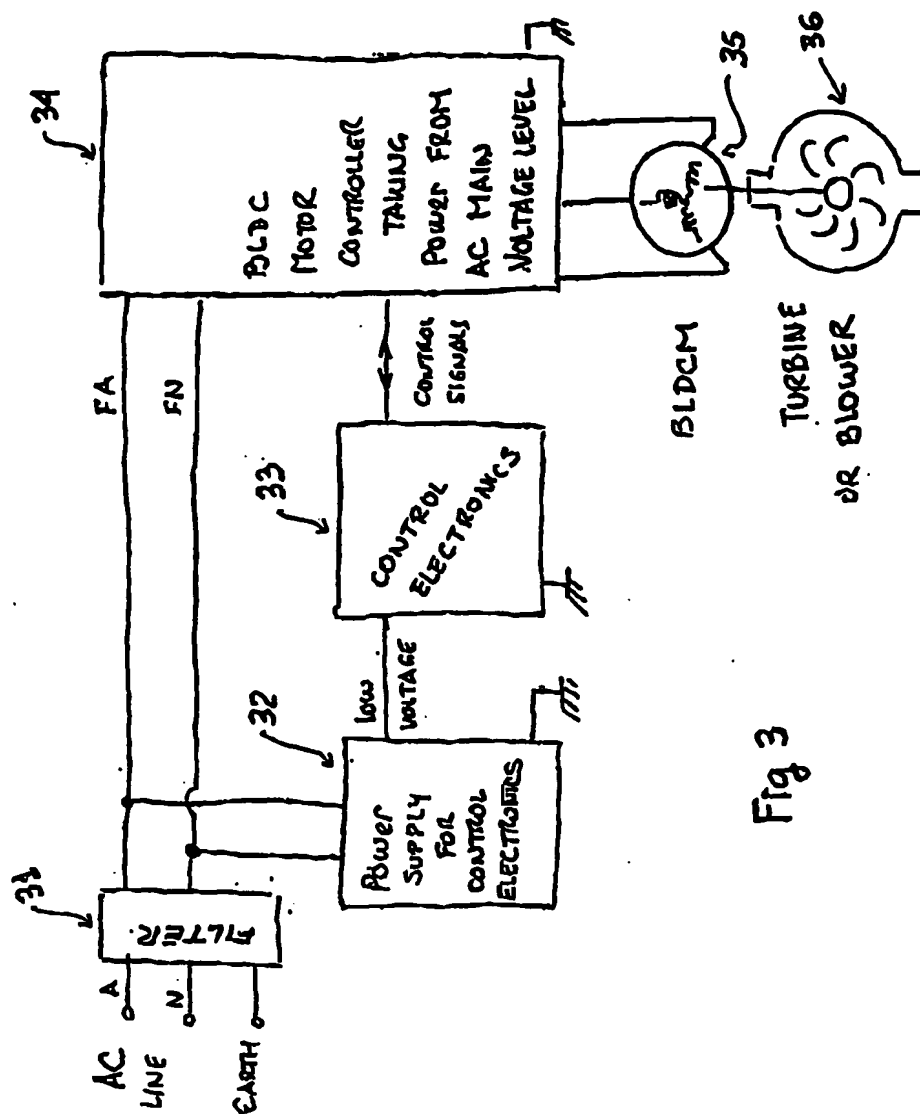


Fig 2

Permanent magnet brushless DC motor



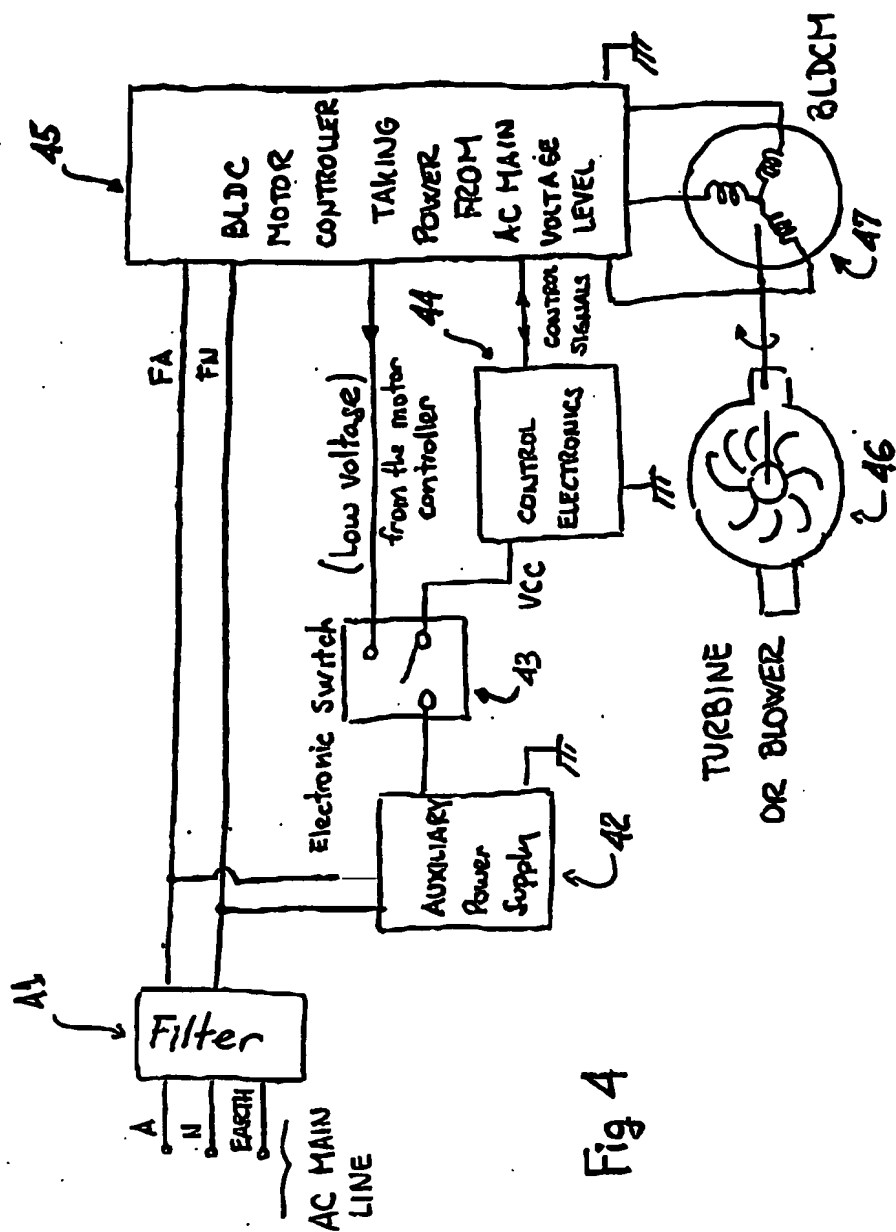


Fig 4

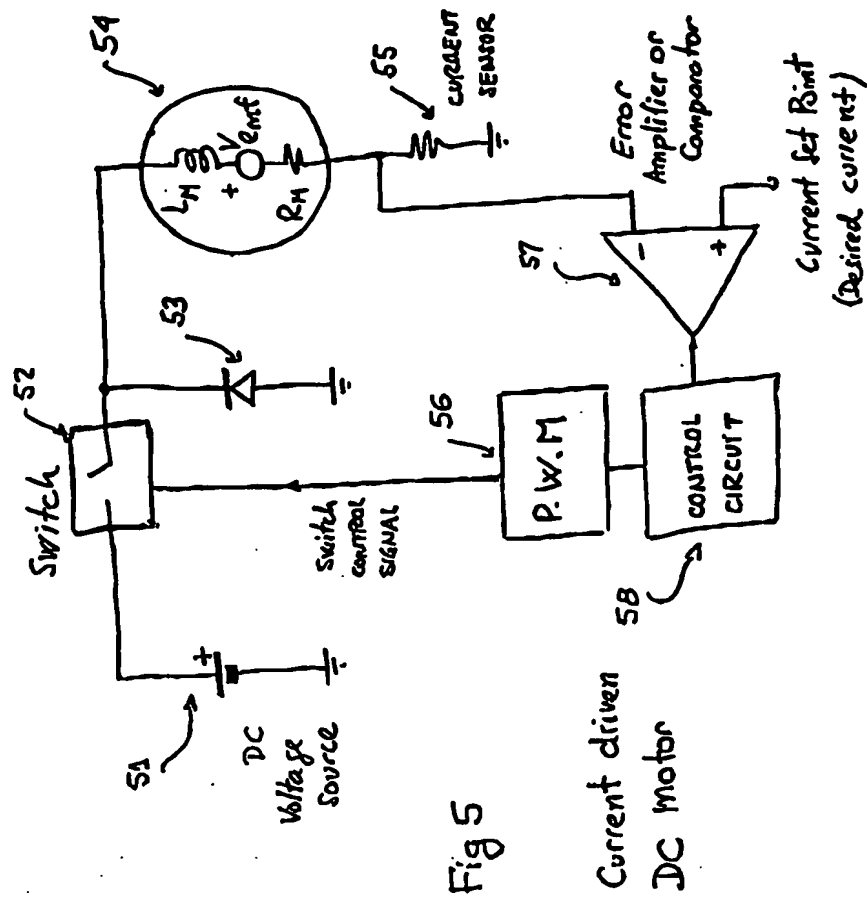
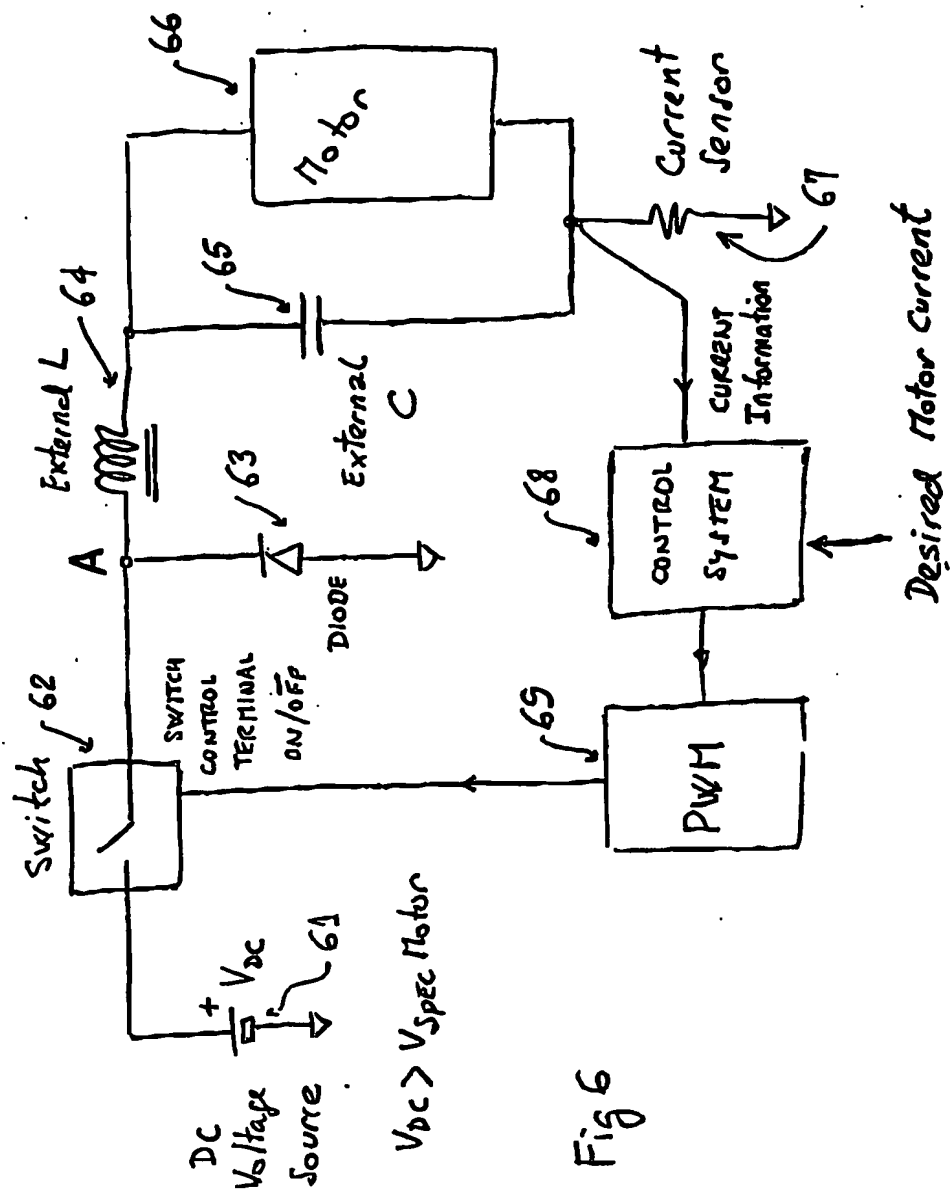
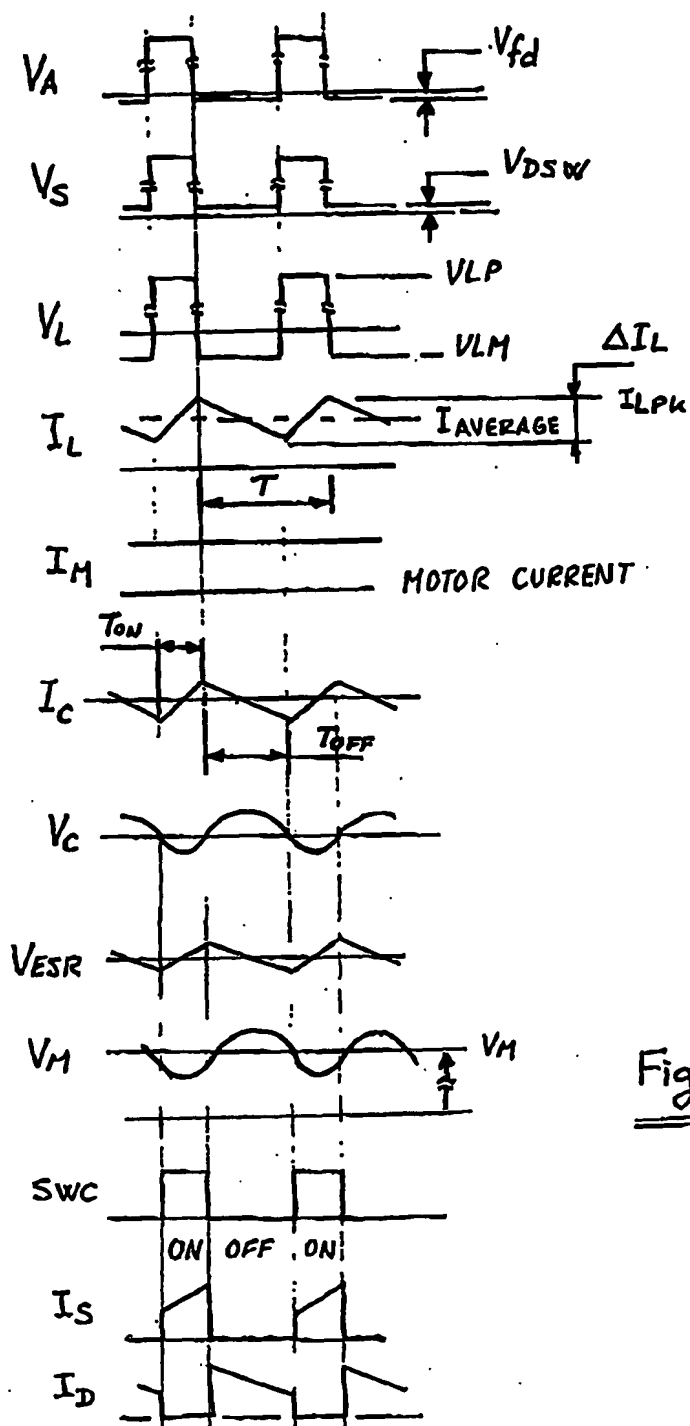


Fig 5



Fig. 6A

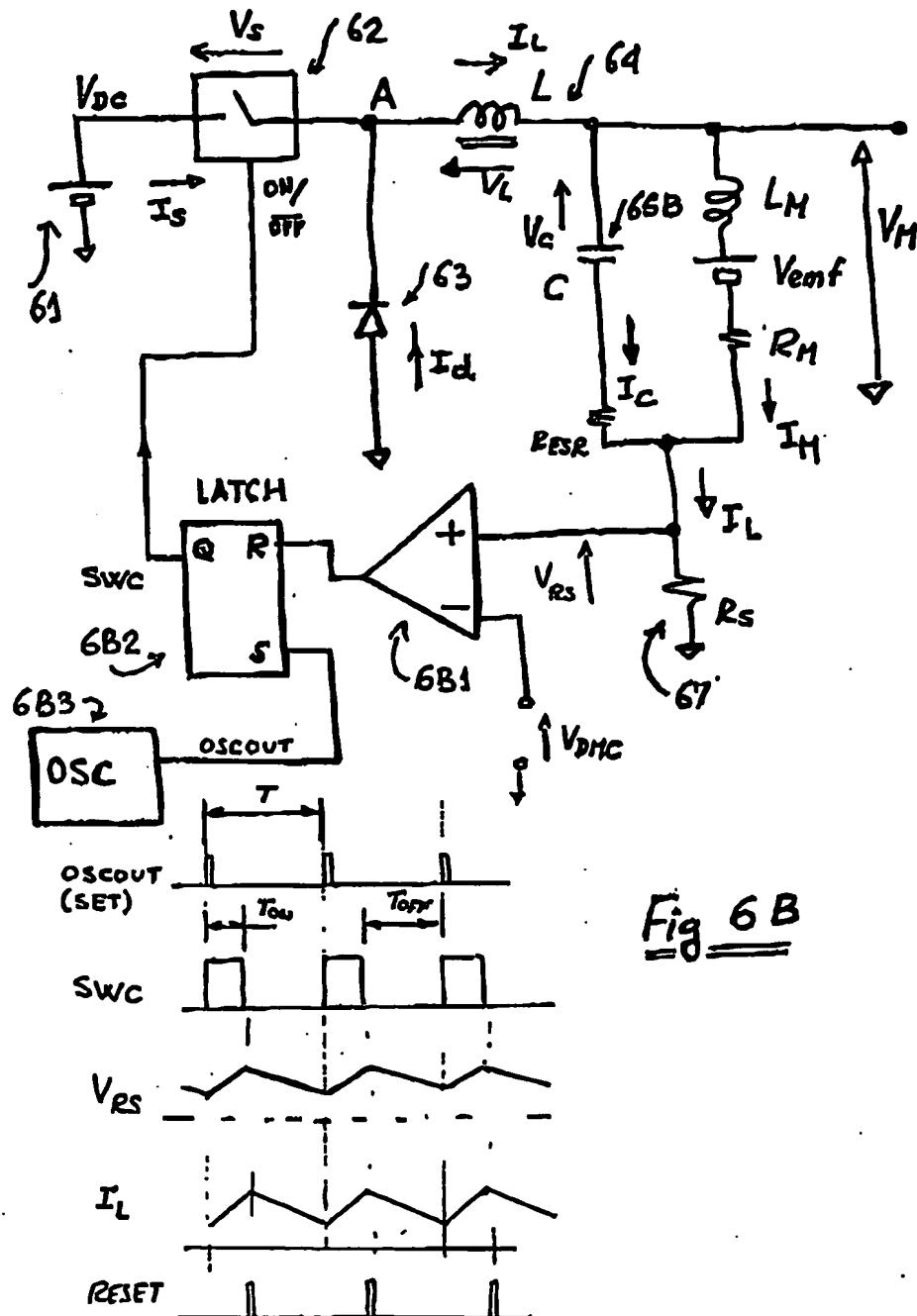


Fig 6 B

Fig 6C-1

- 1)  $V_S = V_{DC} - V_A$
- 2)  $V_L = V_A - V_M$
- 3)  $V_M \cong I_M R_M + V_{emf}$
- 4)  $V_{emf} = k_v \omega_M$
- 5)  $I_S = I_L$
- 6)  $I_L = I_C + I_M$
- 7)  $I_L = V_{RS} / R_S$
- 8)  $V_M = V_C + I_C R_{ESR}$
- 9)  $T = T_{ON} + T_{OFF}$
- 10)  $I_L = I_{AVERAGE} + I_L(t)$
- 11)  $I_{L PK} = I_{AVERAGE} + \Delta I_L / 2$
- 12)  $I_{L MIN} = I_{AVERAGE} - \Delta I_L / 2$
- 13)  $I_M = I_{AVERAGE}$
- 14)  $I_C = I_L(t)$
- 15)  $I_L(t) = \frac{1}{L} \int V_L(t) dt$
- 16)  $I_L = \frac{V_L}{L} t = \frac{V_A - V_M}{L} t$
- 17)  $I_L = \frac{V_{DC} - V_S - V_M}{L} t$

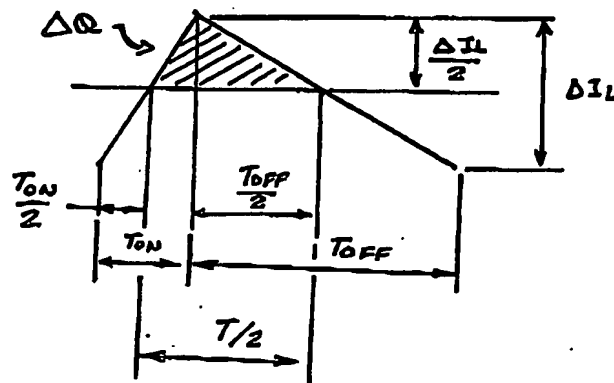
$$18) \Delta I_L = \frac{V_{DC} - V_S - V_{TH}}{L} T_{ON} \quad \text{Fig 6C-2}$$

$$19) |\Delta I_L| = \frac{V_{TH} + V_{fsl}}{L} T_{OFF}$$

$$20) \frac{V_{DC} - V_S - V_{TH}}{L} T_{ON} = \frac{V_{TH} + V_{fsl}}{L} T_{OFF}$$

$$21) (V_{DC} - V_{TH}) T_{ON} \cong V_{TH} T_{OFF}$$

$$22) V_{TH} \cong V_{DC} \frac{T_{ON}}{T_{ON} + T_{OFF}} = V_{DC} \frac{T_{ON}}{T}$$



$$23) \Delta Q = \frac{1}{2} \cdot \frac{T}{2} \cdot \frac{\Delta I_L}{2}$$

$$24) \Delta V_{C_c} = \frac{\Delta Q}{C} = \frac{\Delta I_L}{f 8 C}$$

$$25) \Delta V_C = \Delta V_{C_c} + \Delta I_L R_{BSR}$$

$$26) \Delta V_C \ll V_{TH}$$

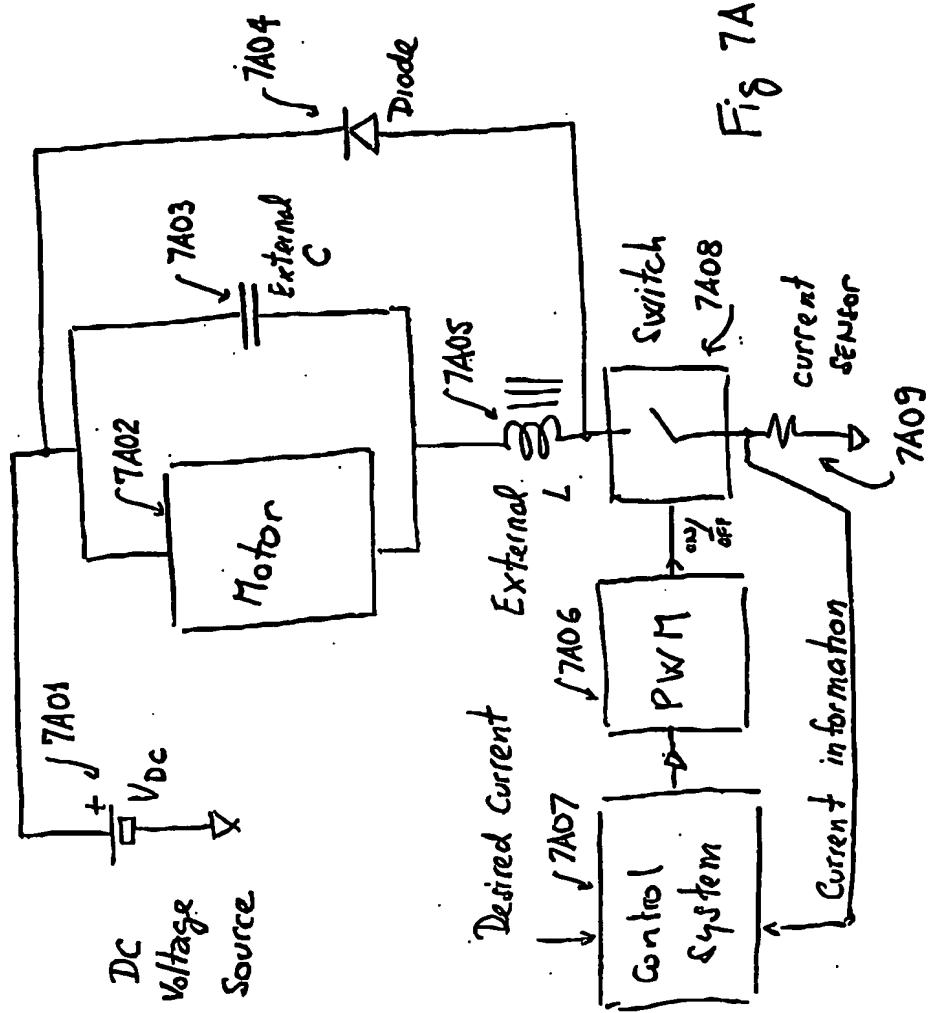


Fig 7A

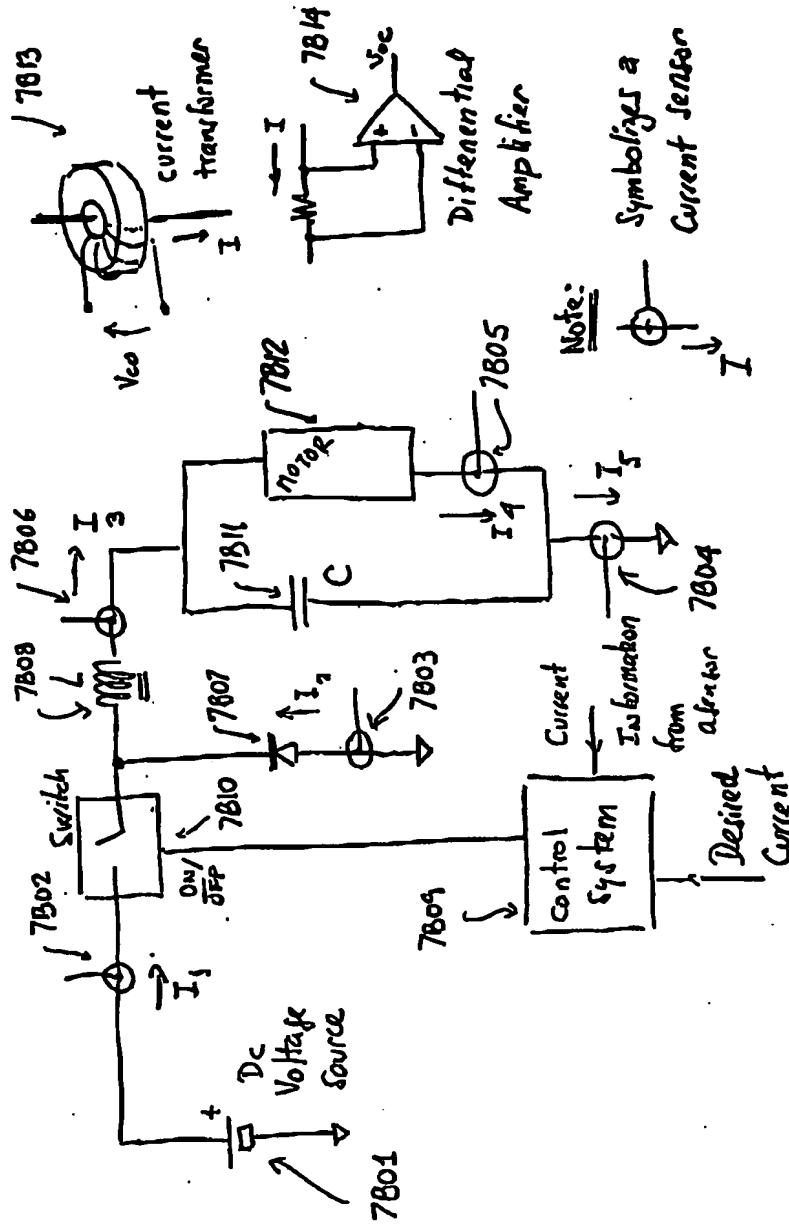


Fig 7B  
Positions of current sensors

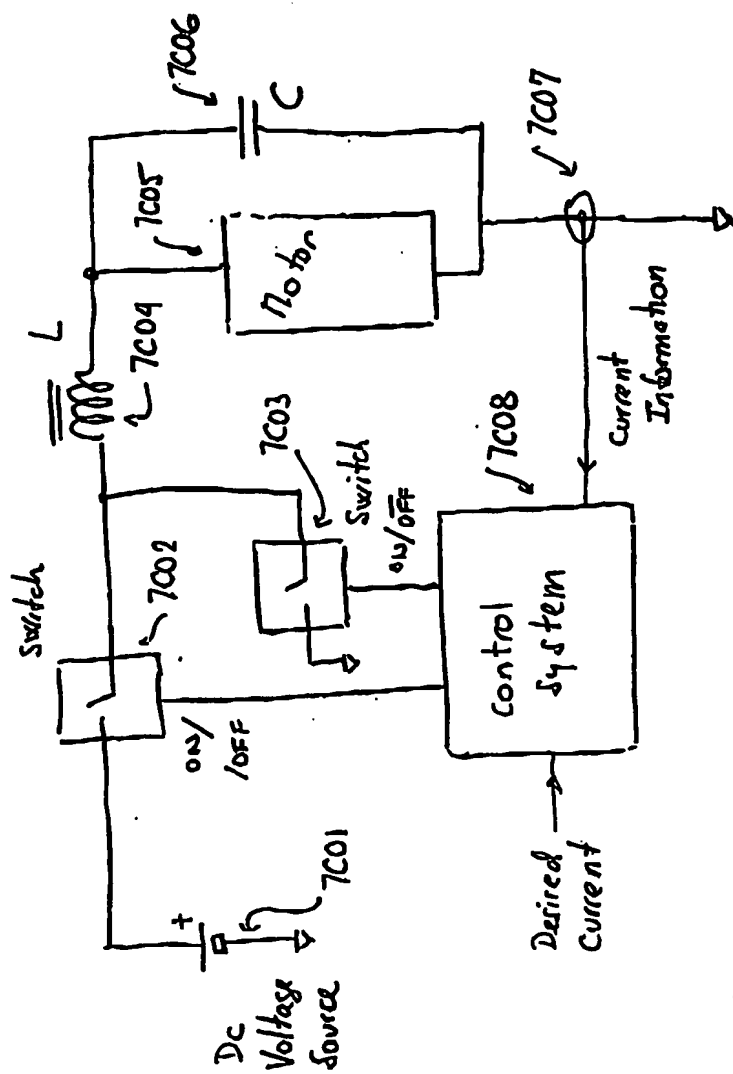
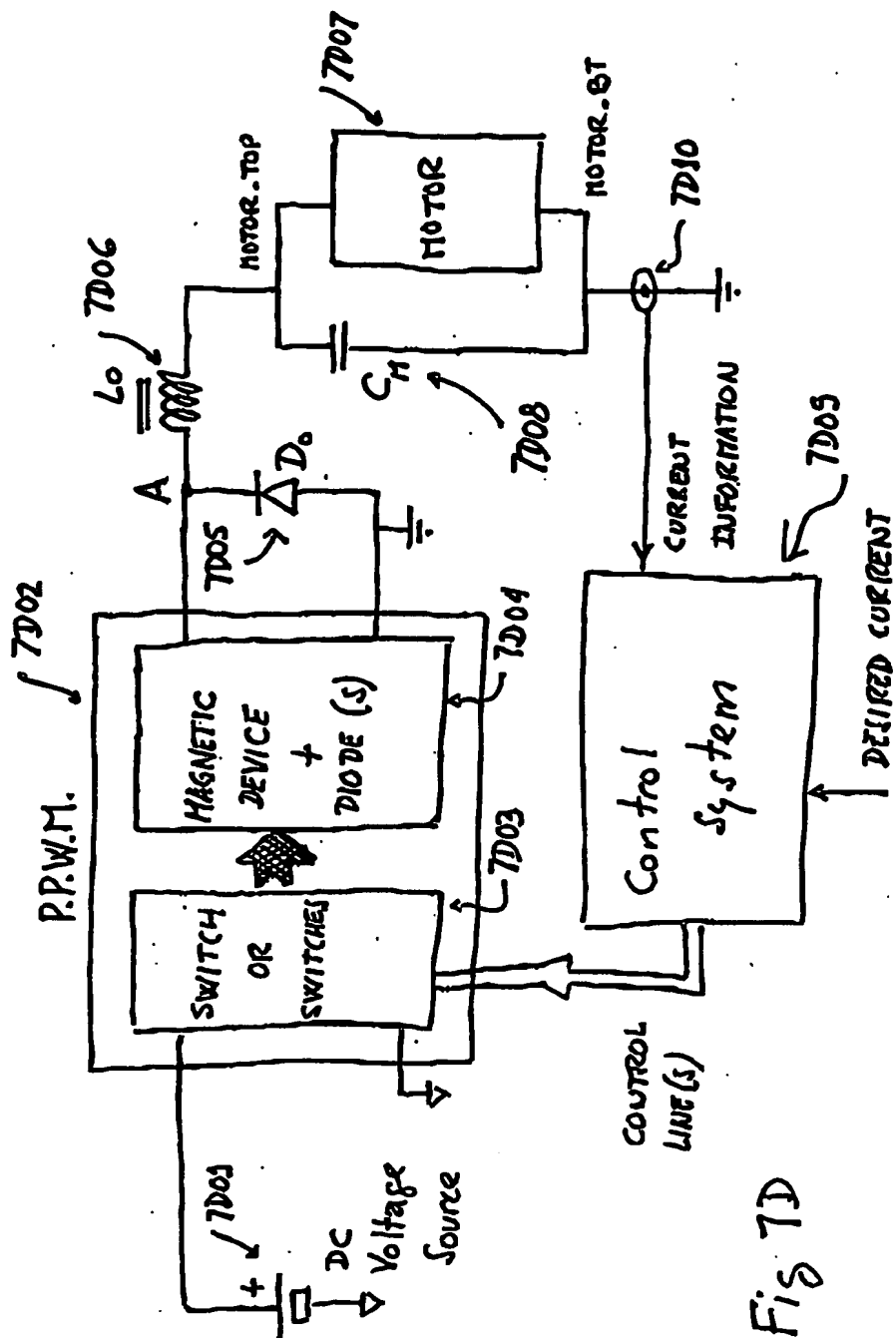


Fig 7C  
With Synchronous rectification



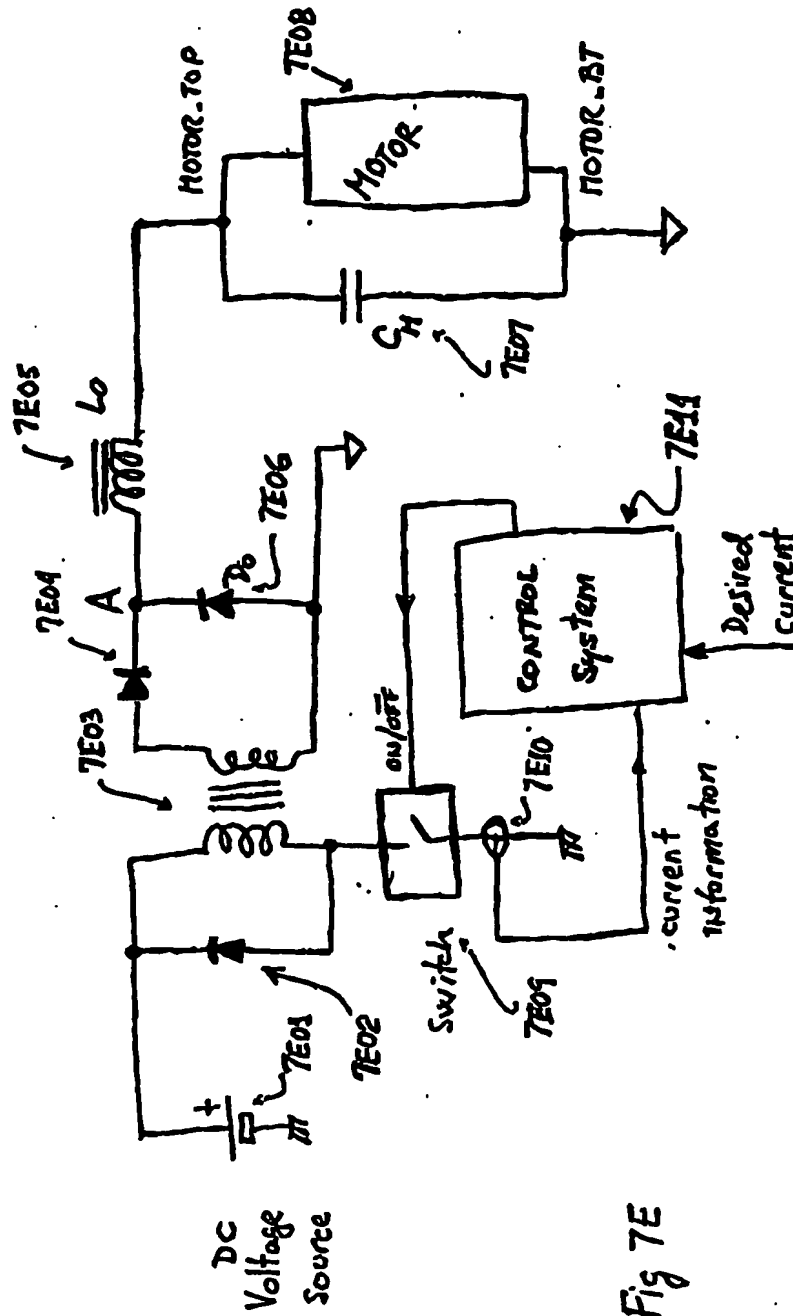
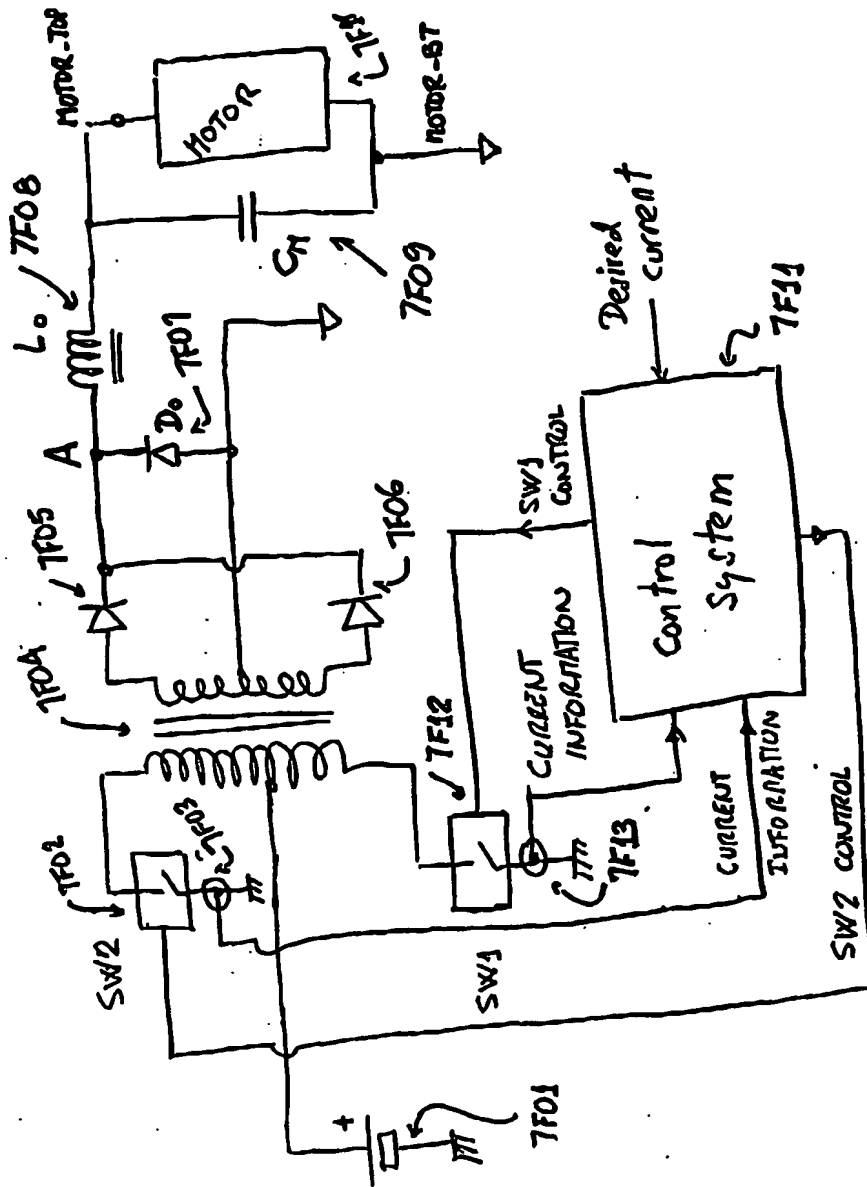


Fig 7E



DC  
Voltage  
Source

Fig 7F



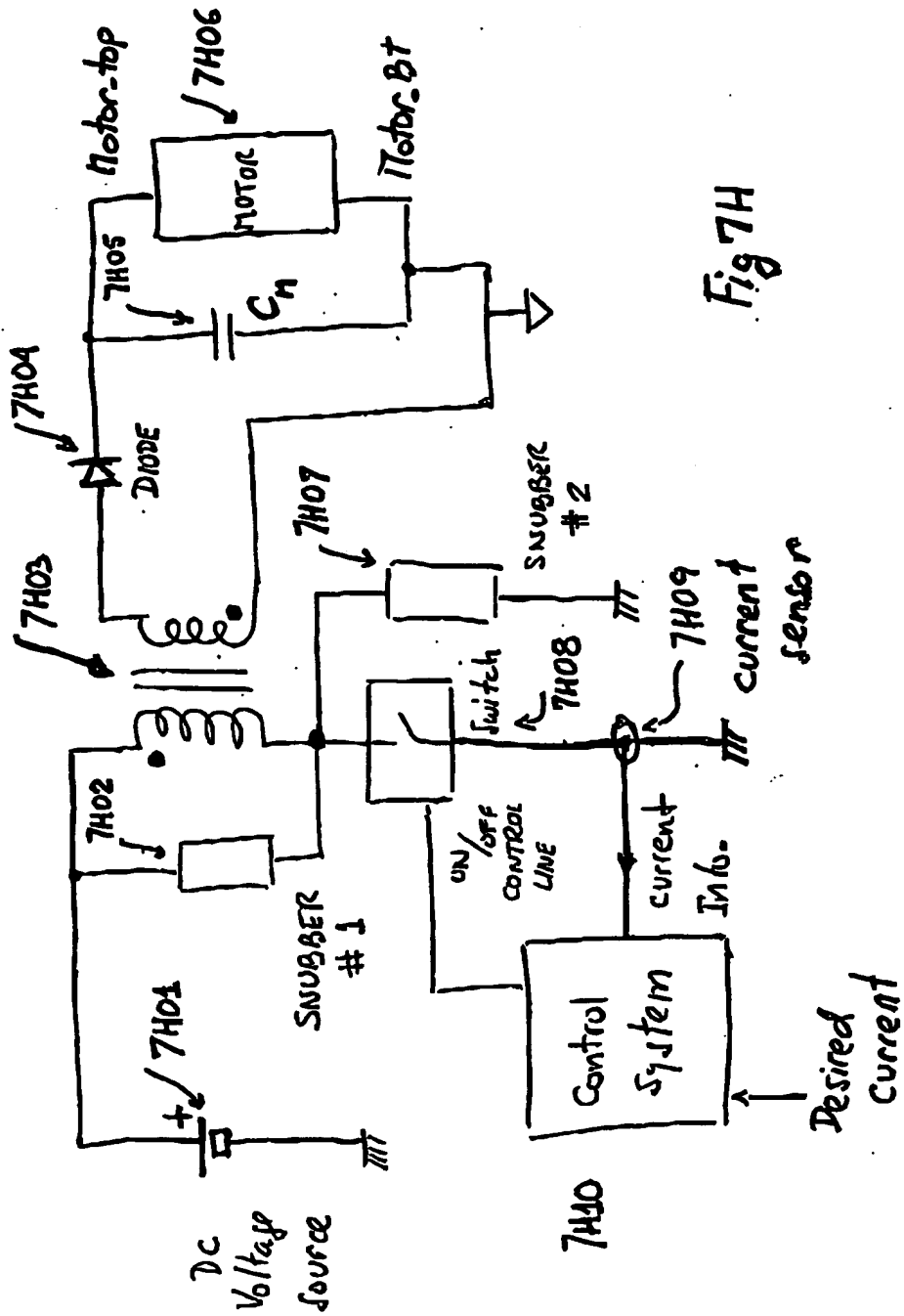


Fig 7H

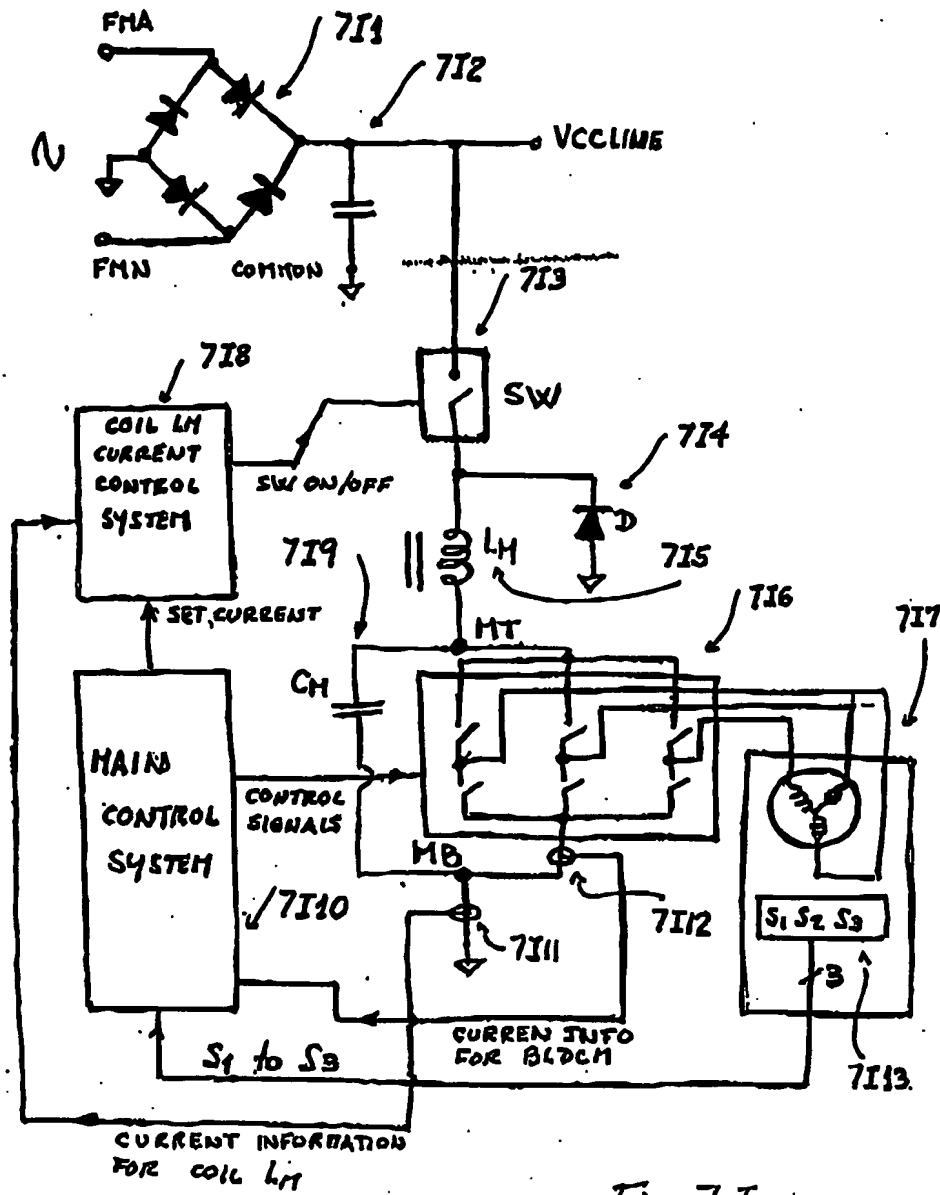
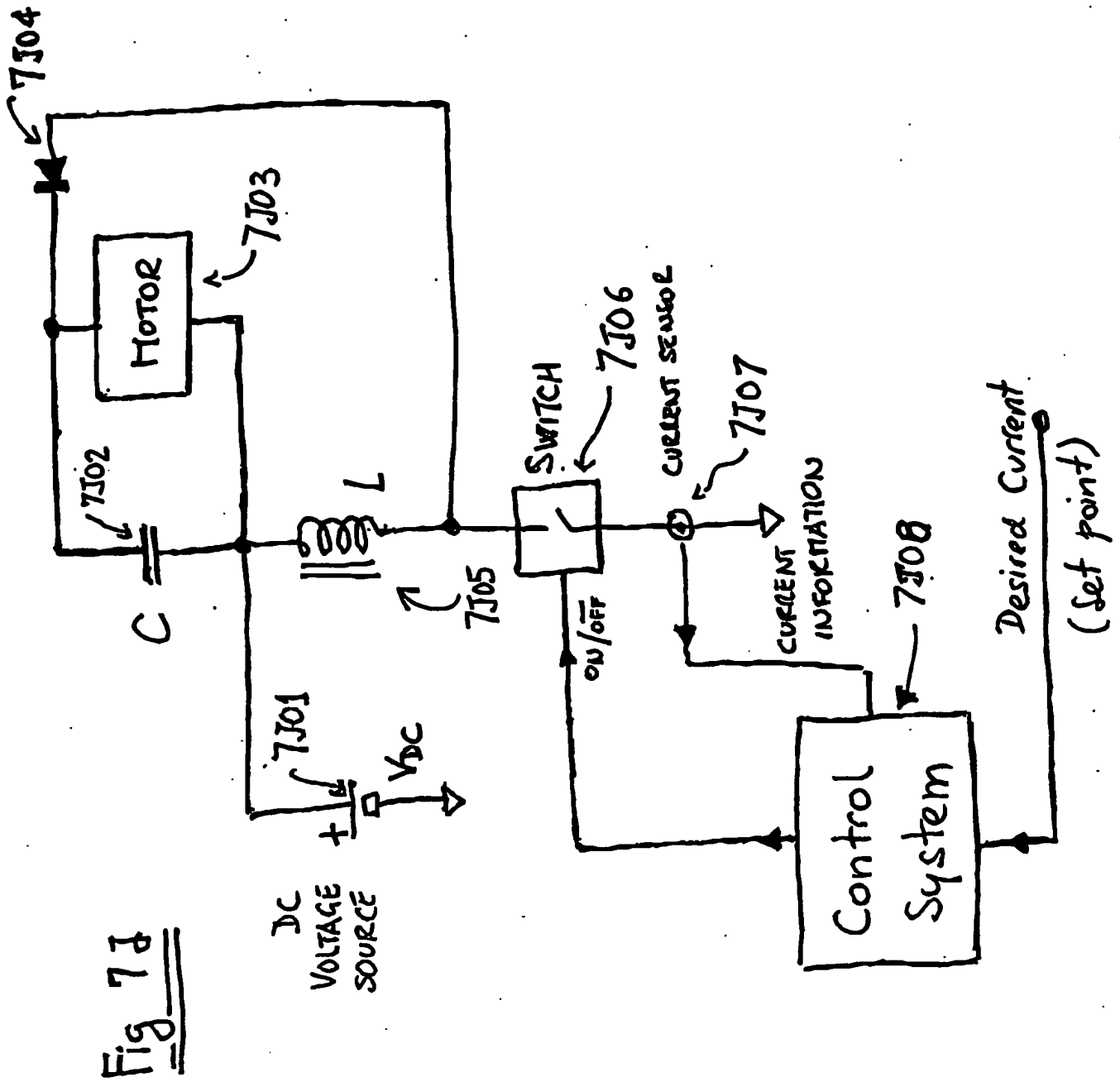


Fig 7I



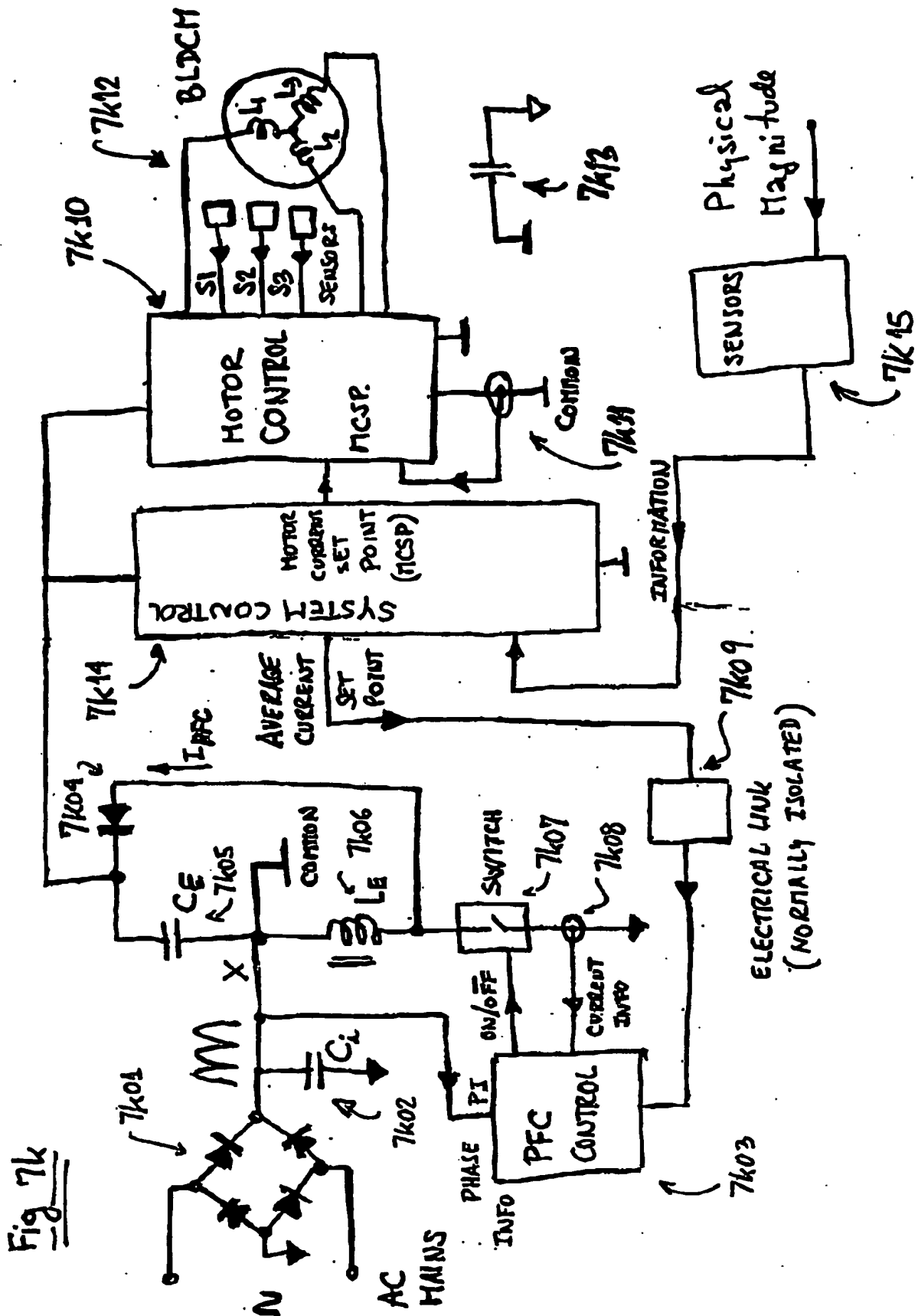


Fig 7L

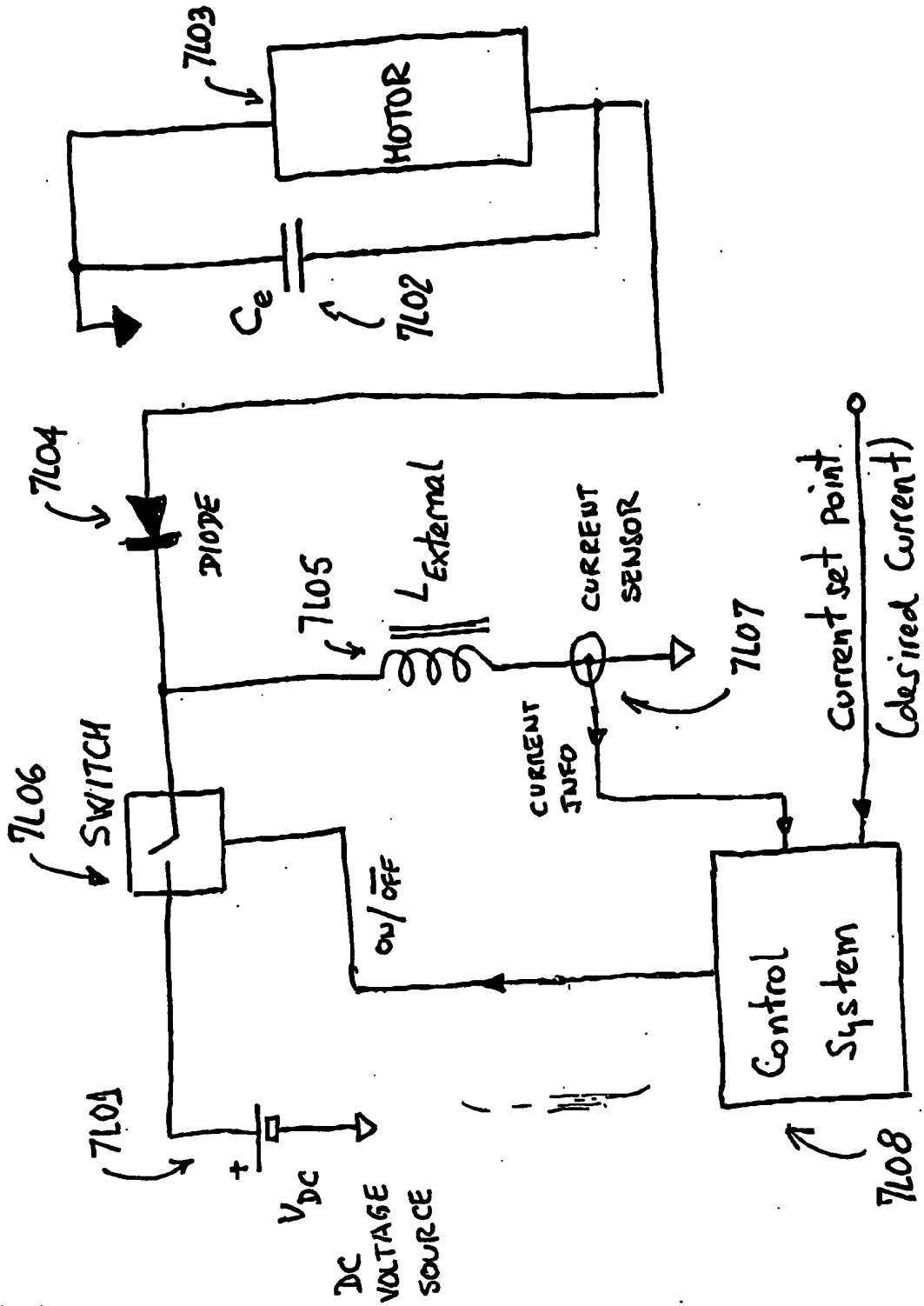


Fig 8A

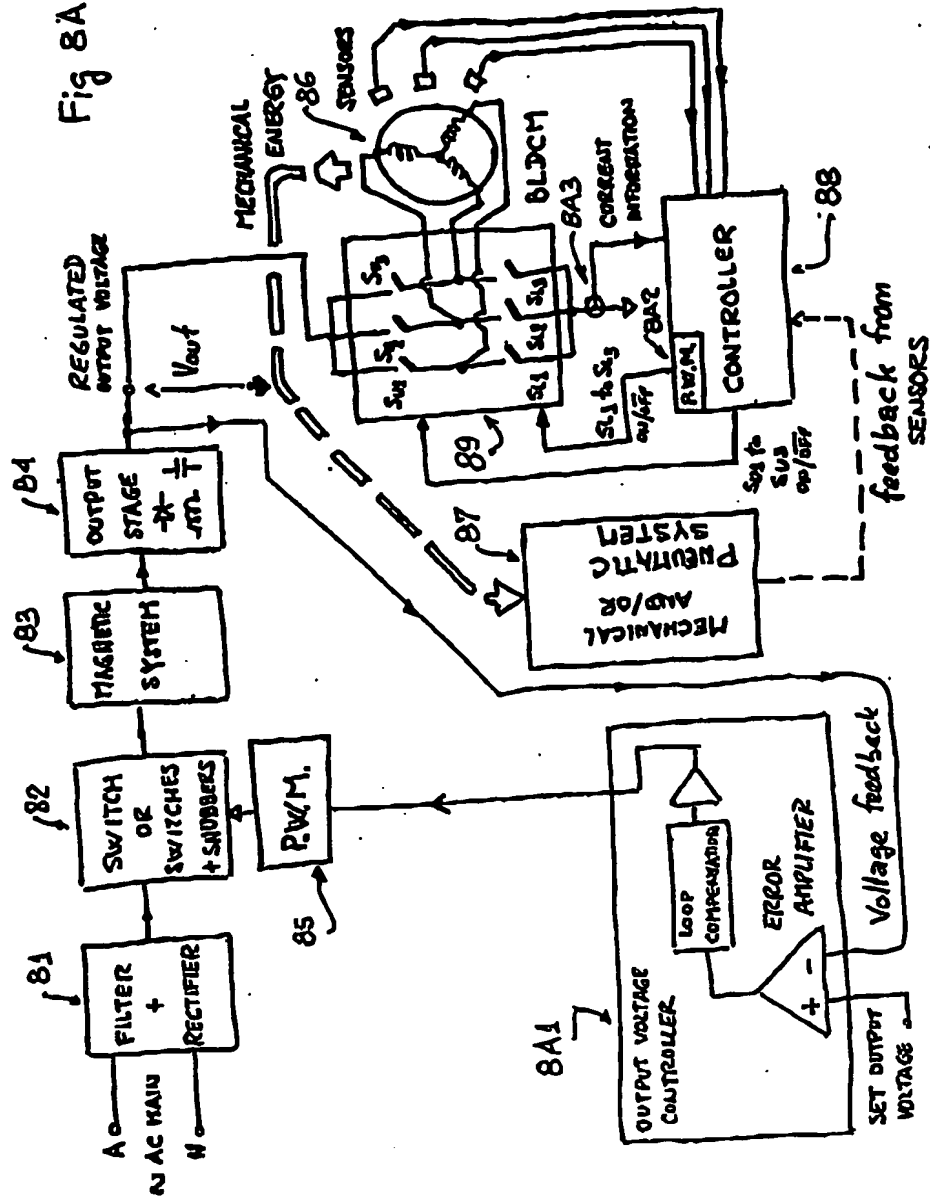


Fig 8B

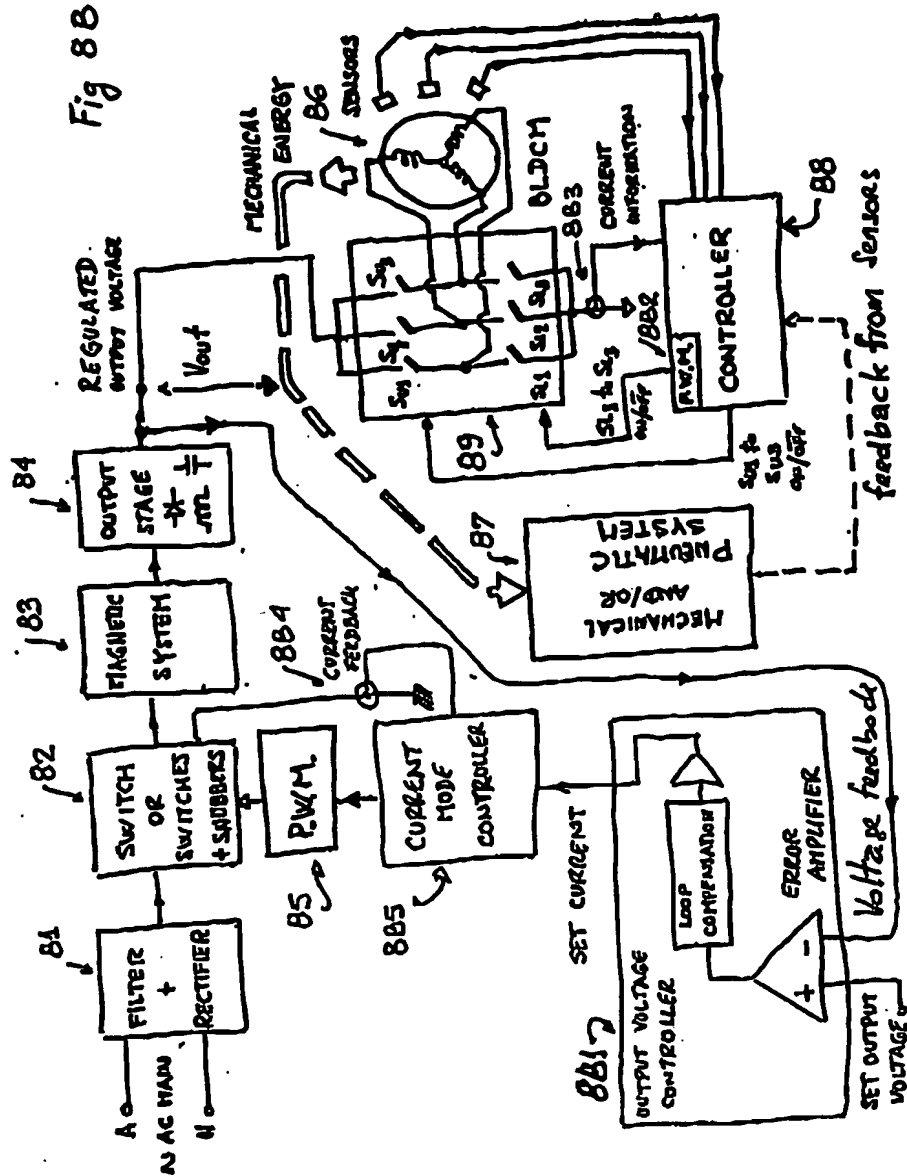
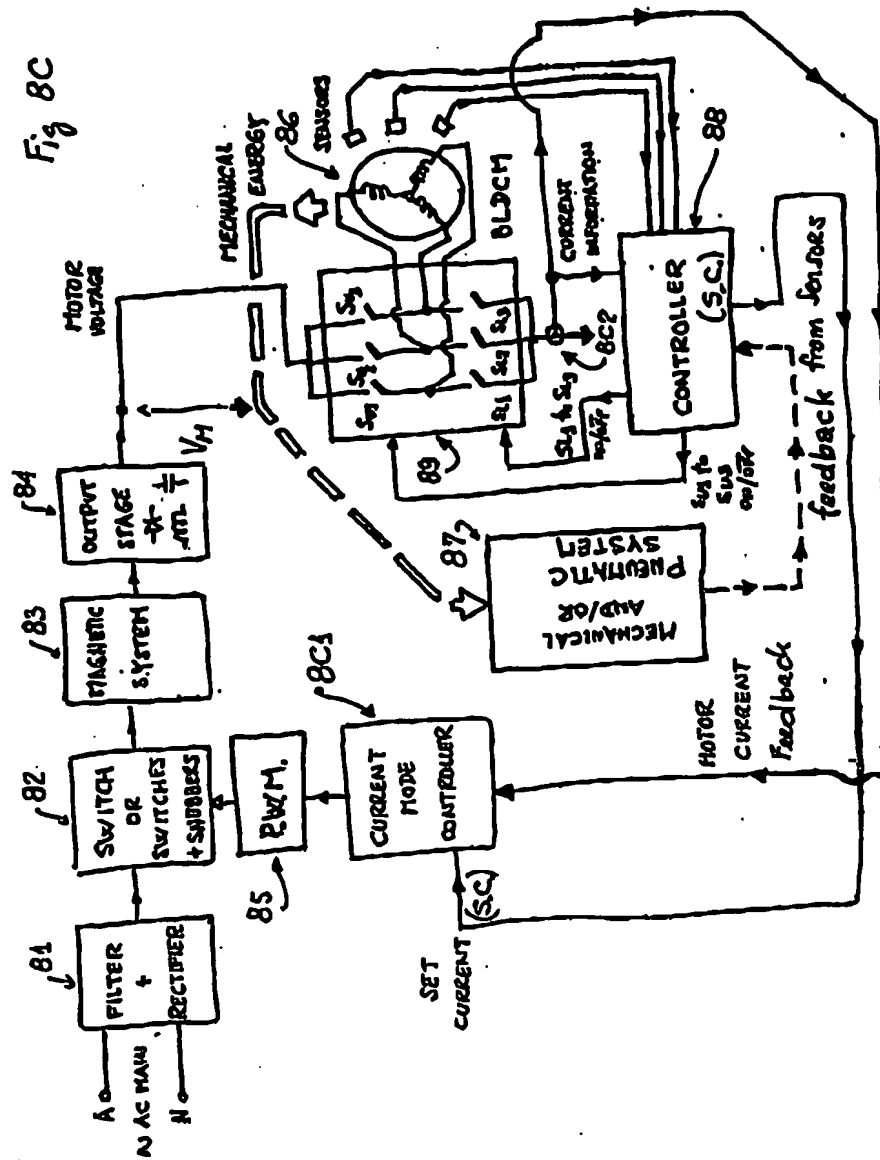
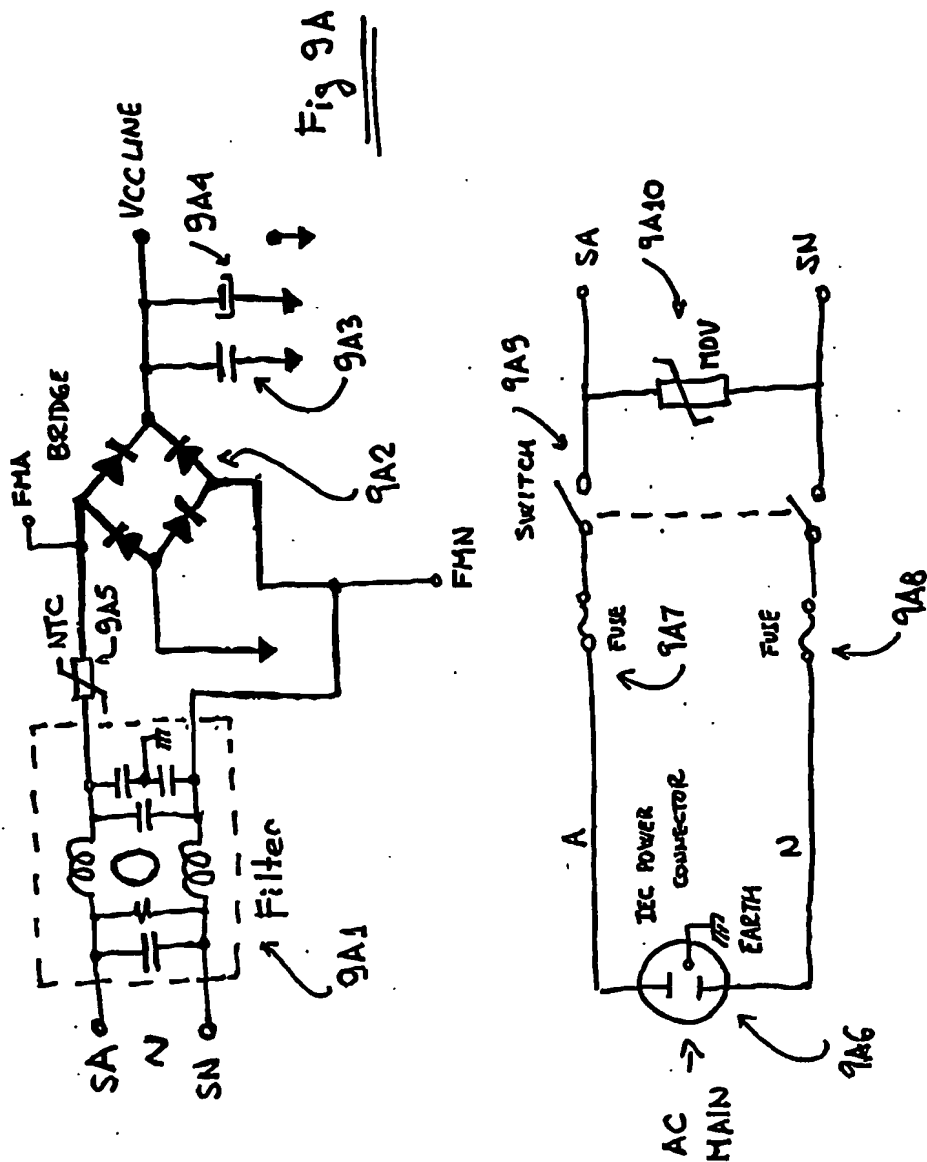
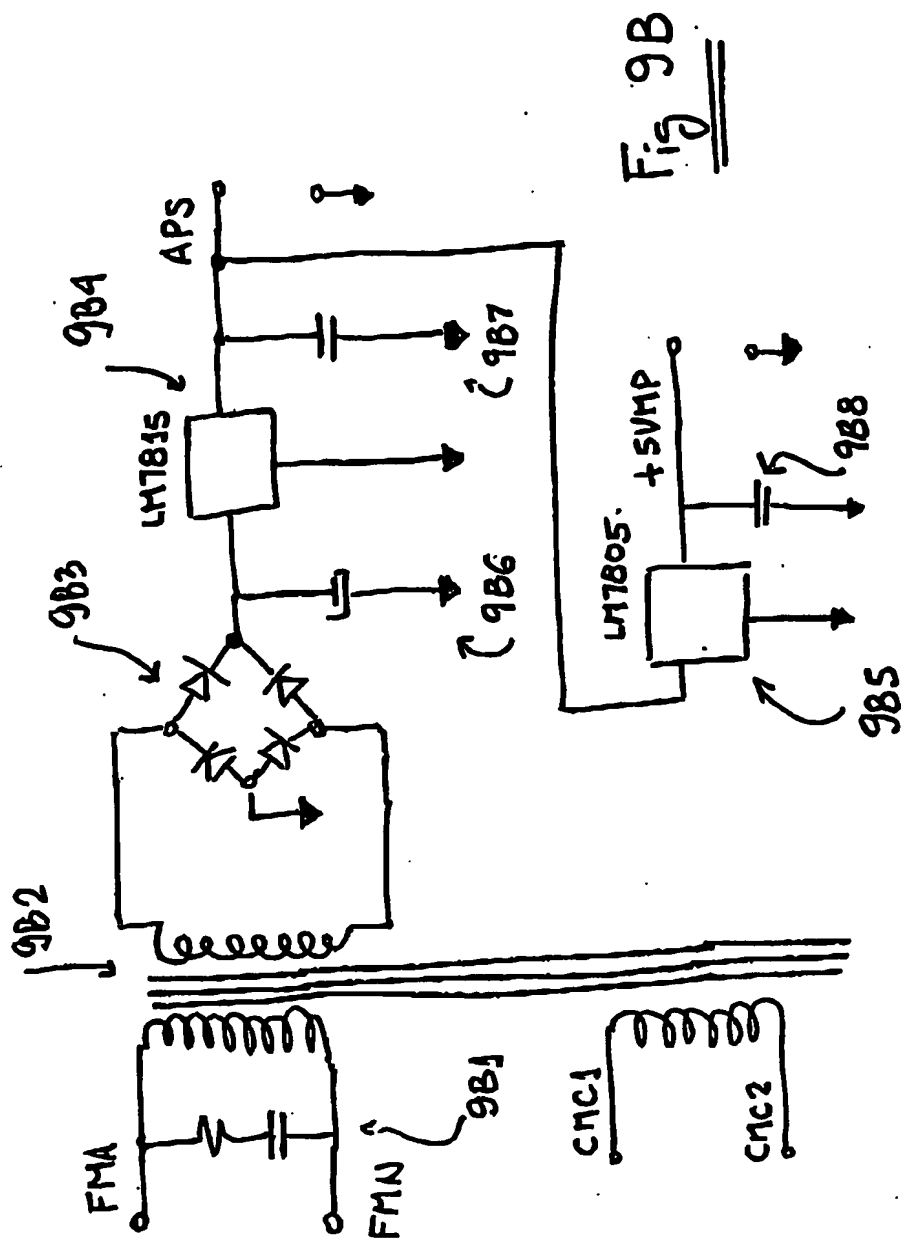


Fig 8C







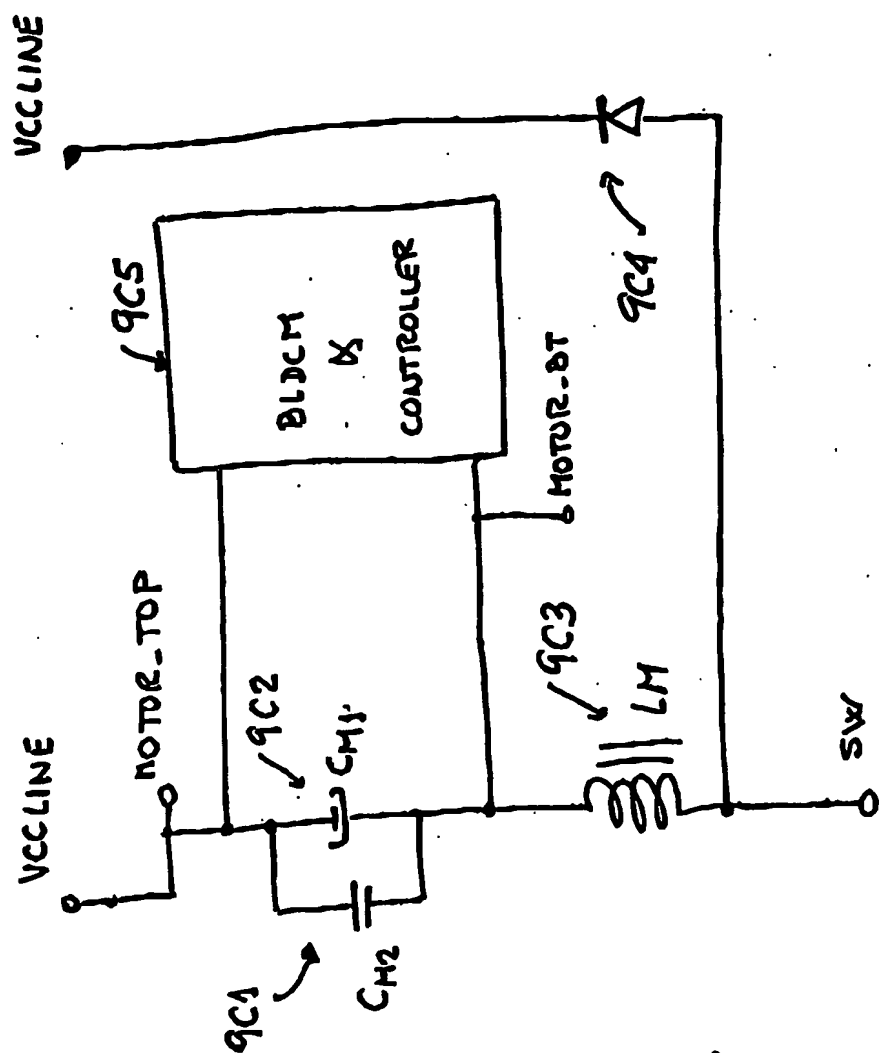


Fig 9C

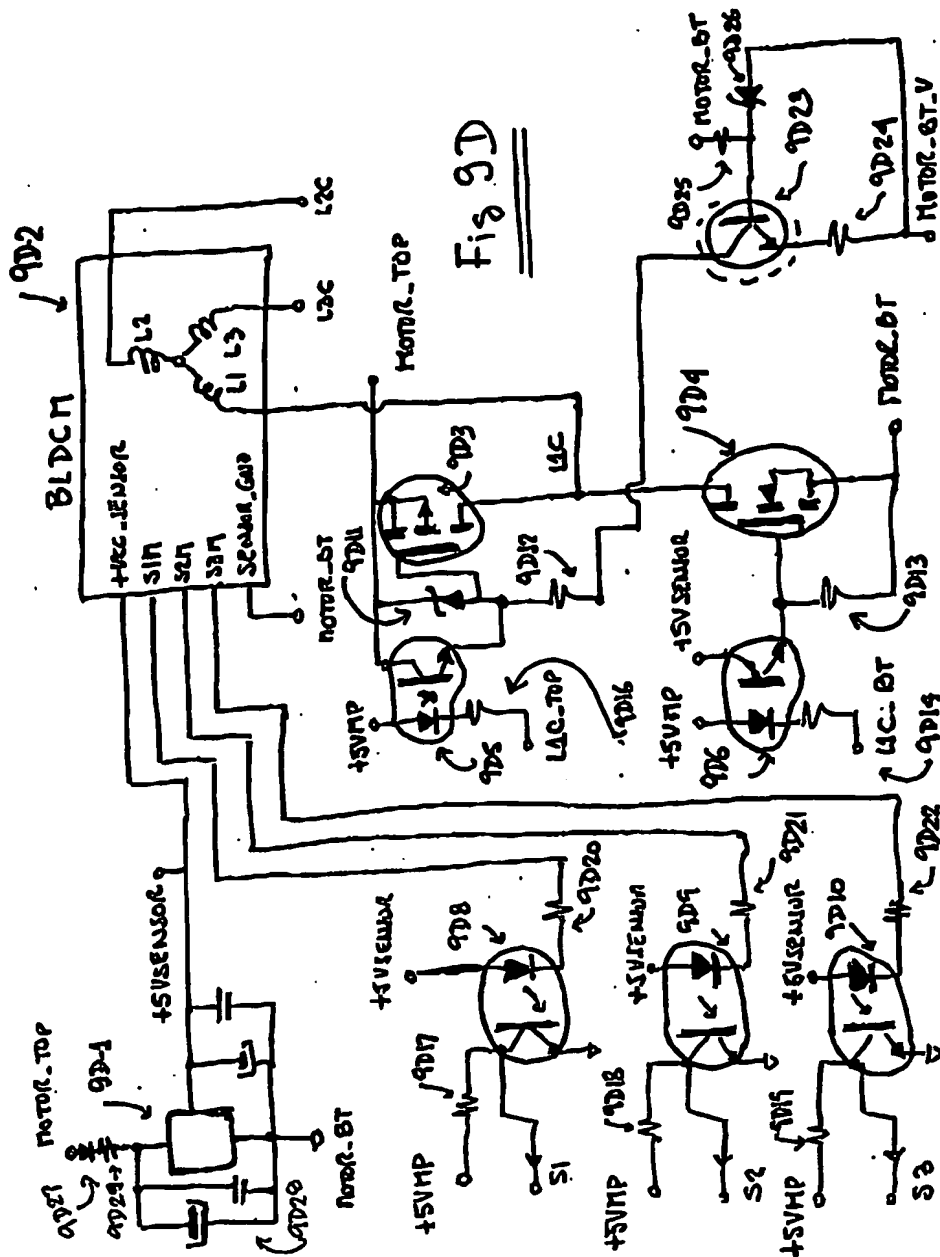


Fig 9E

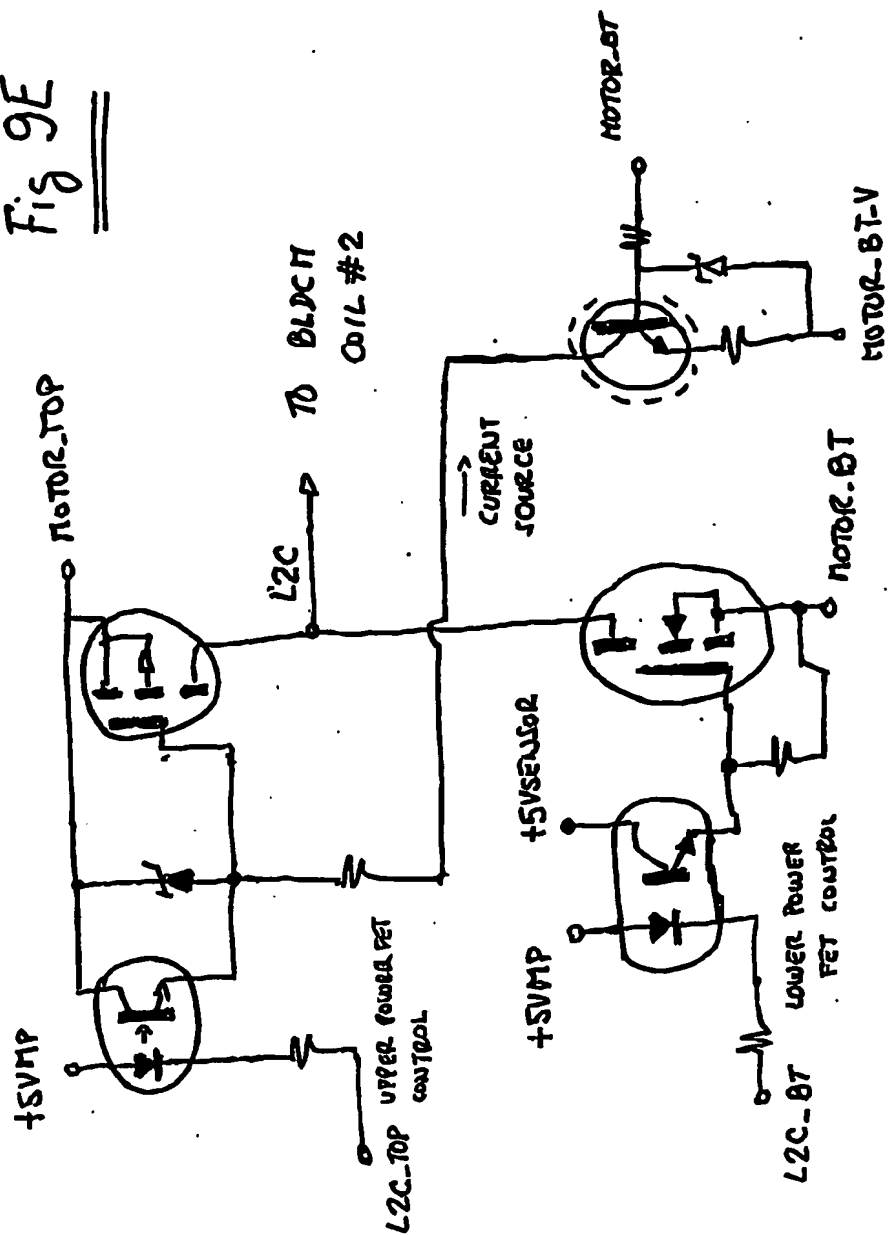
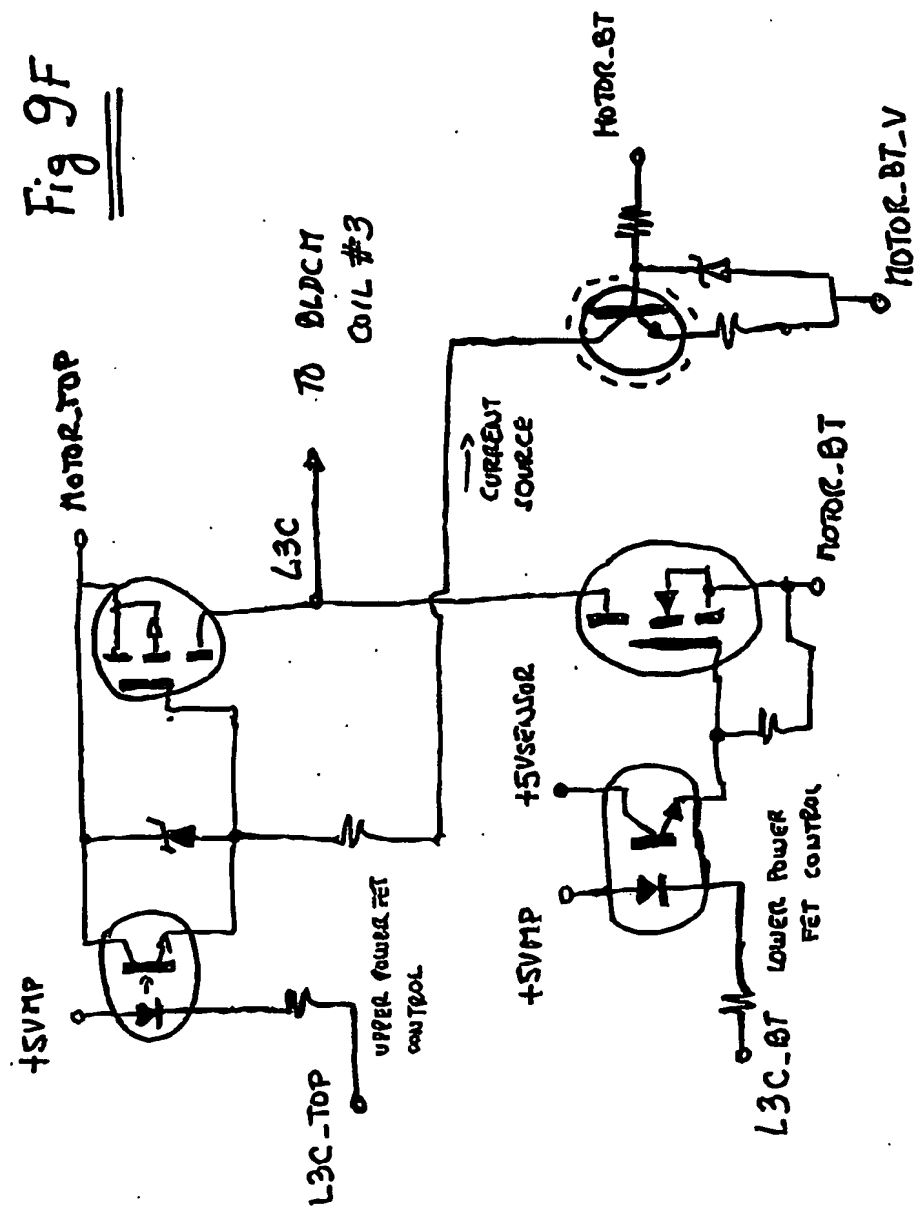
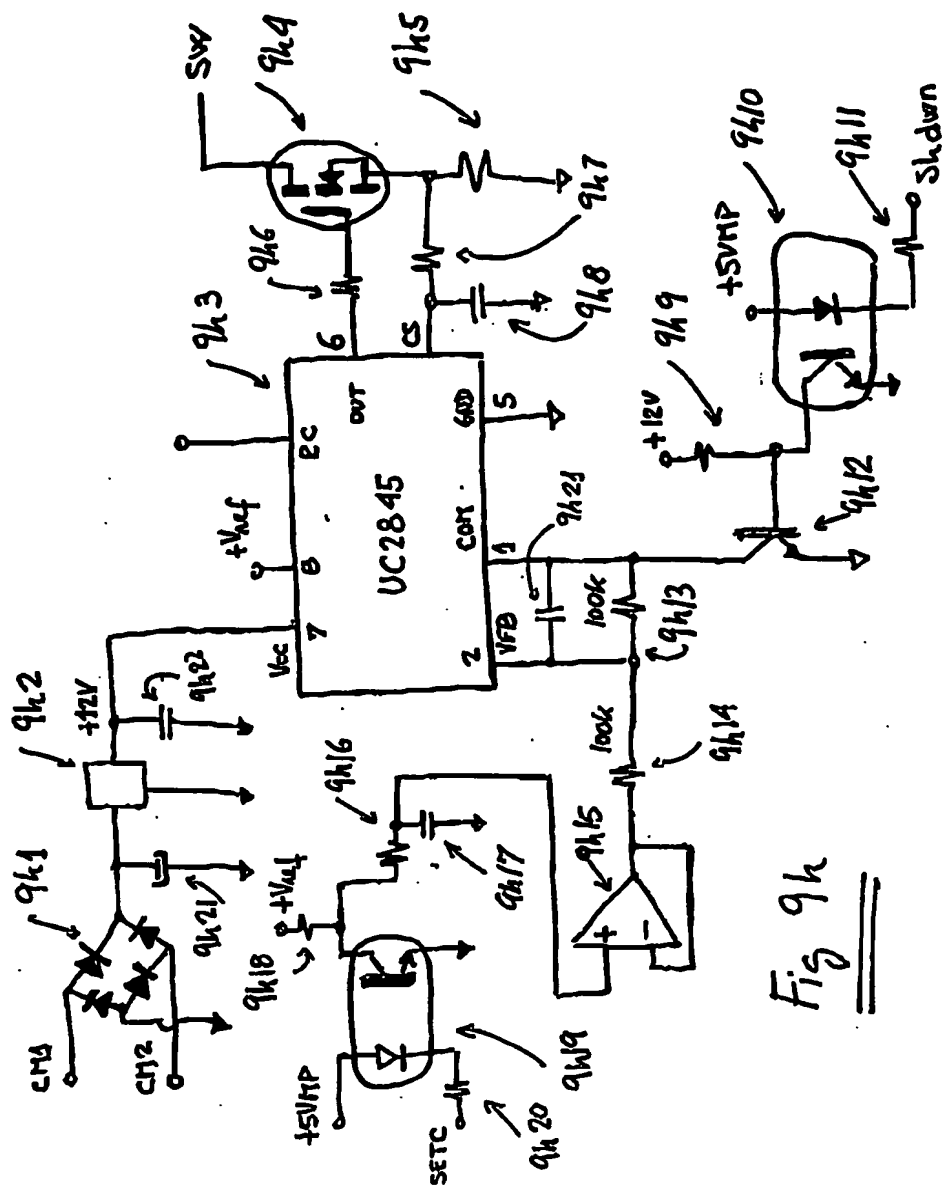
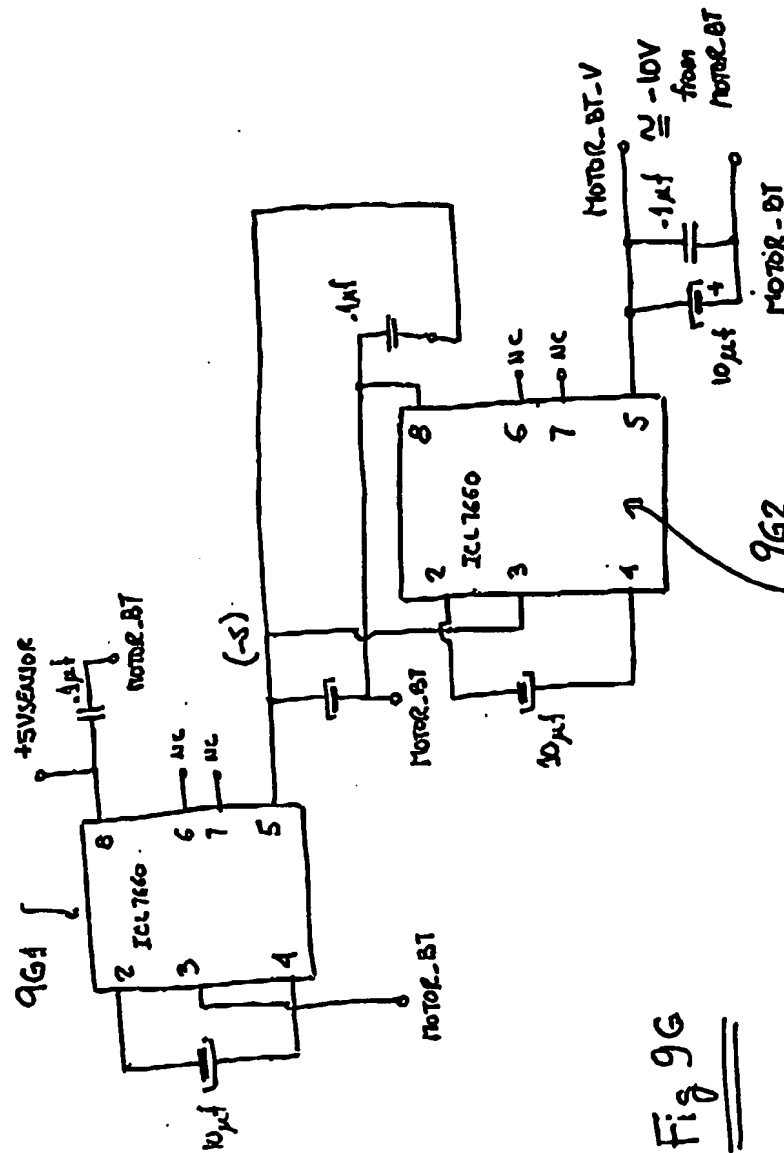
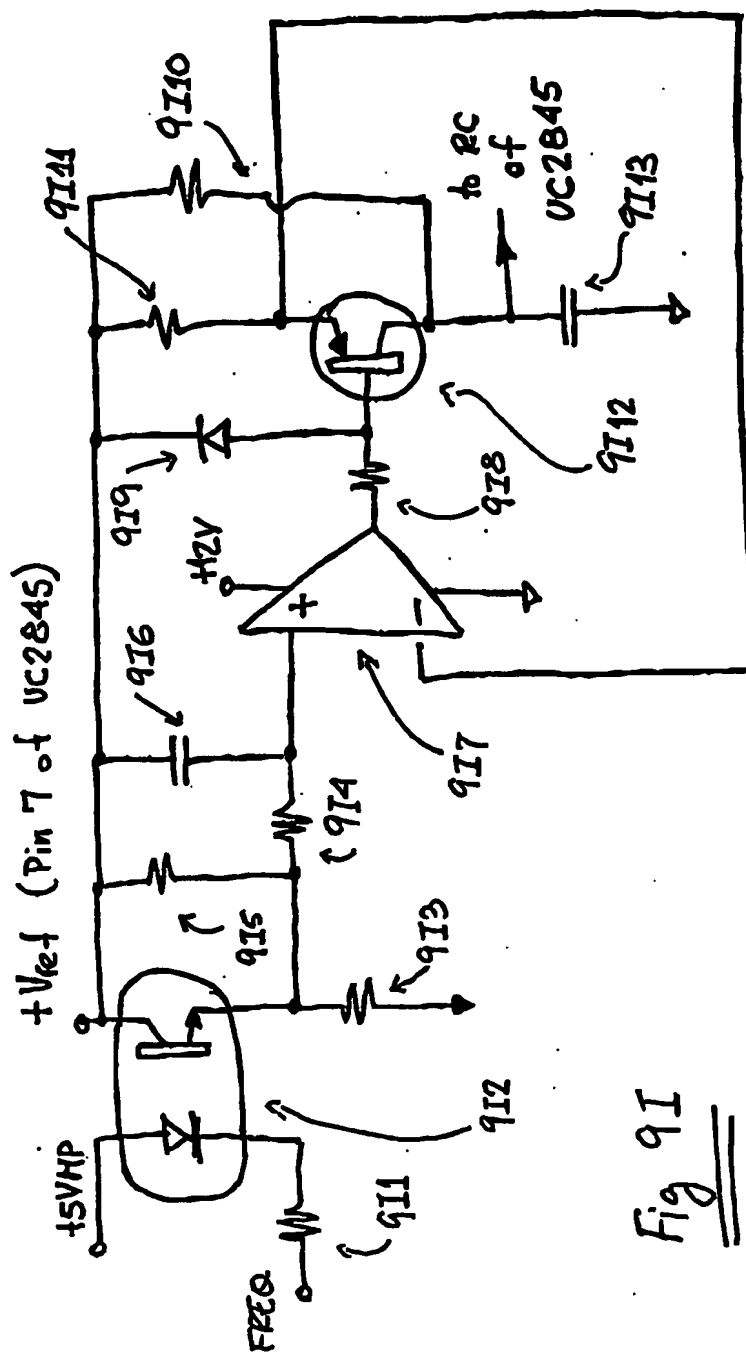


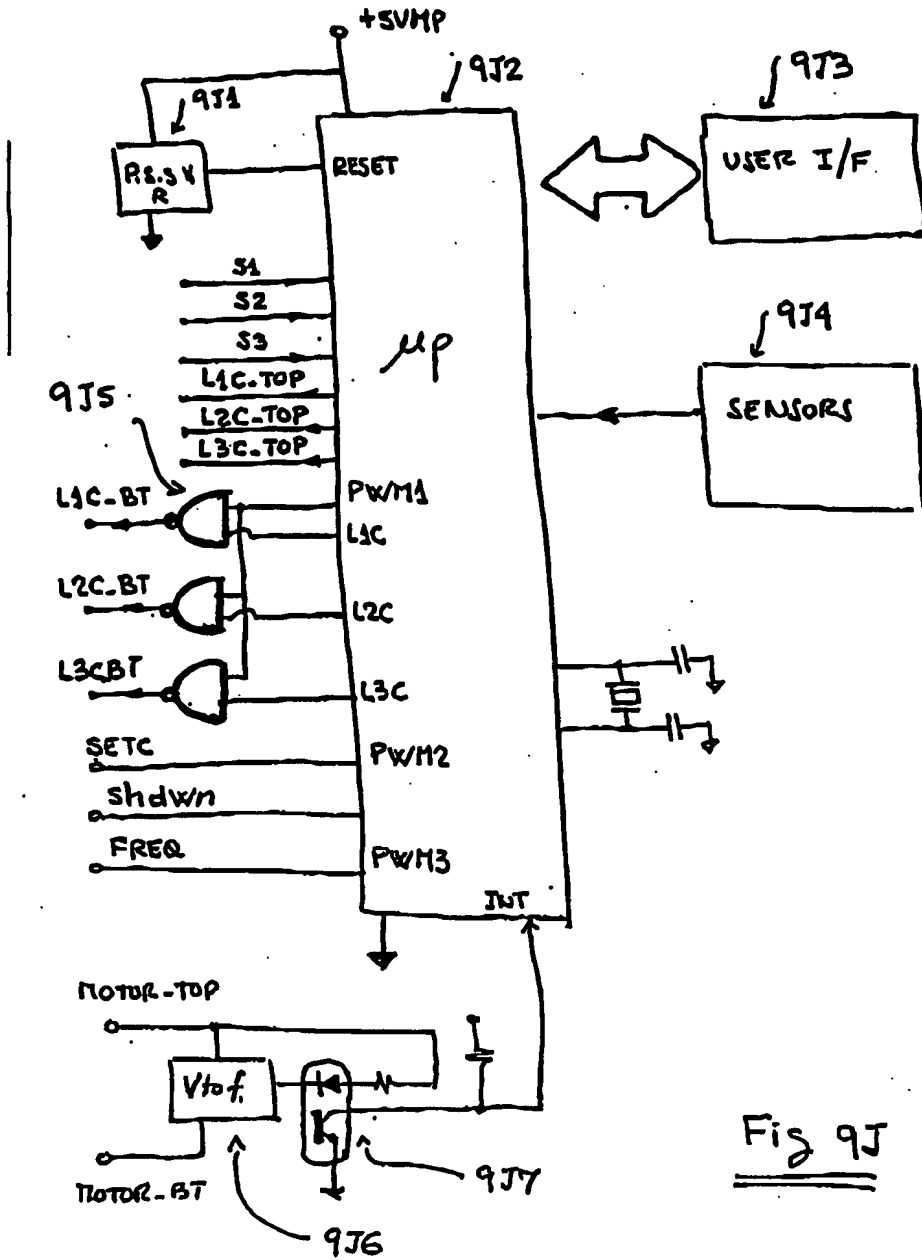
Fig 9F

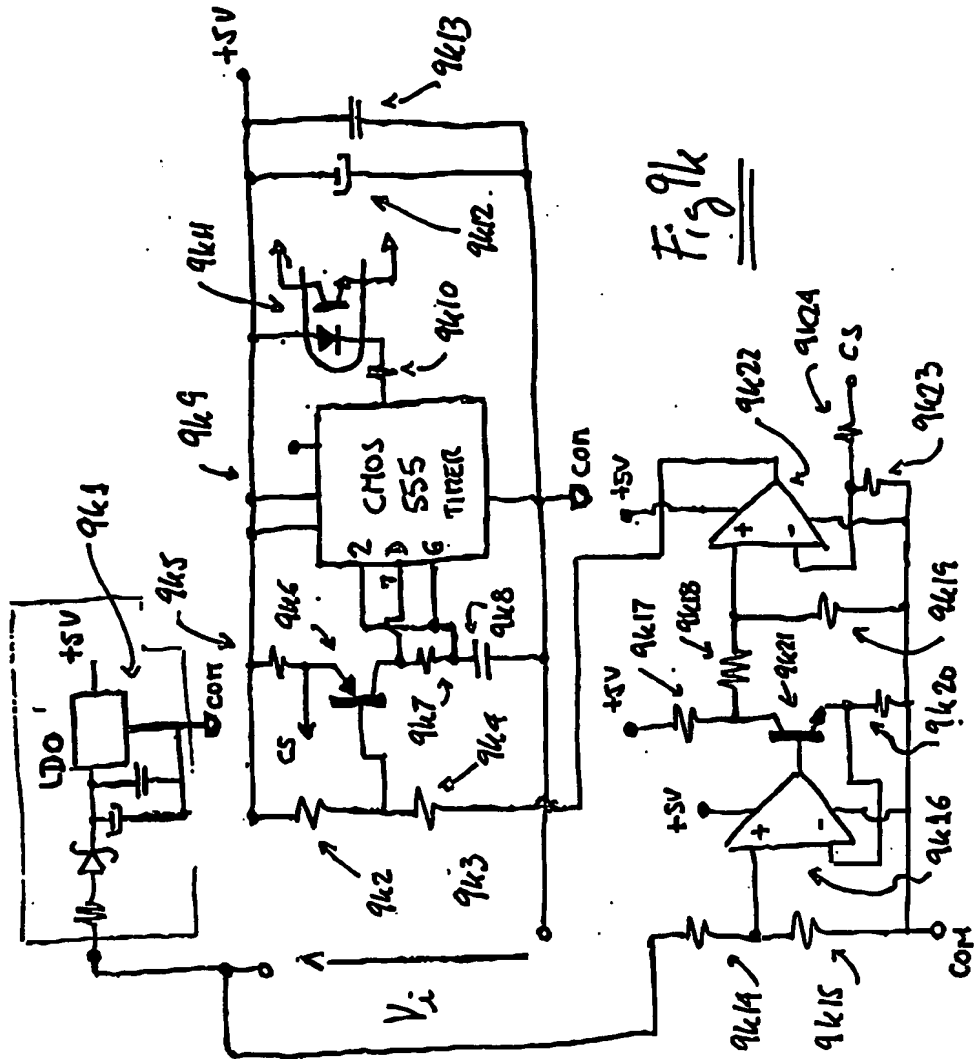


Fig 9k





Fig 9J



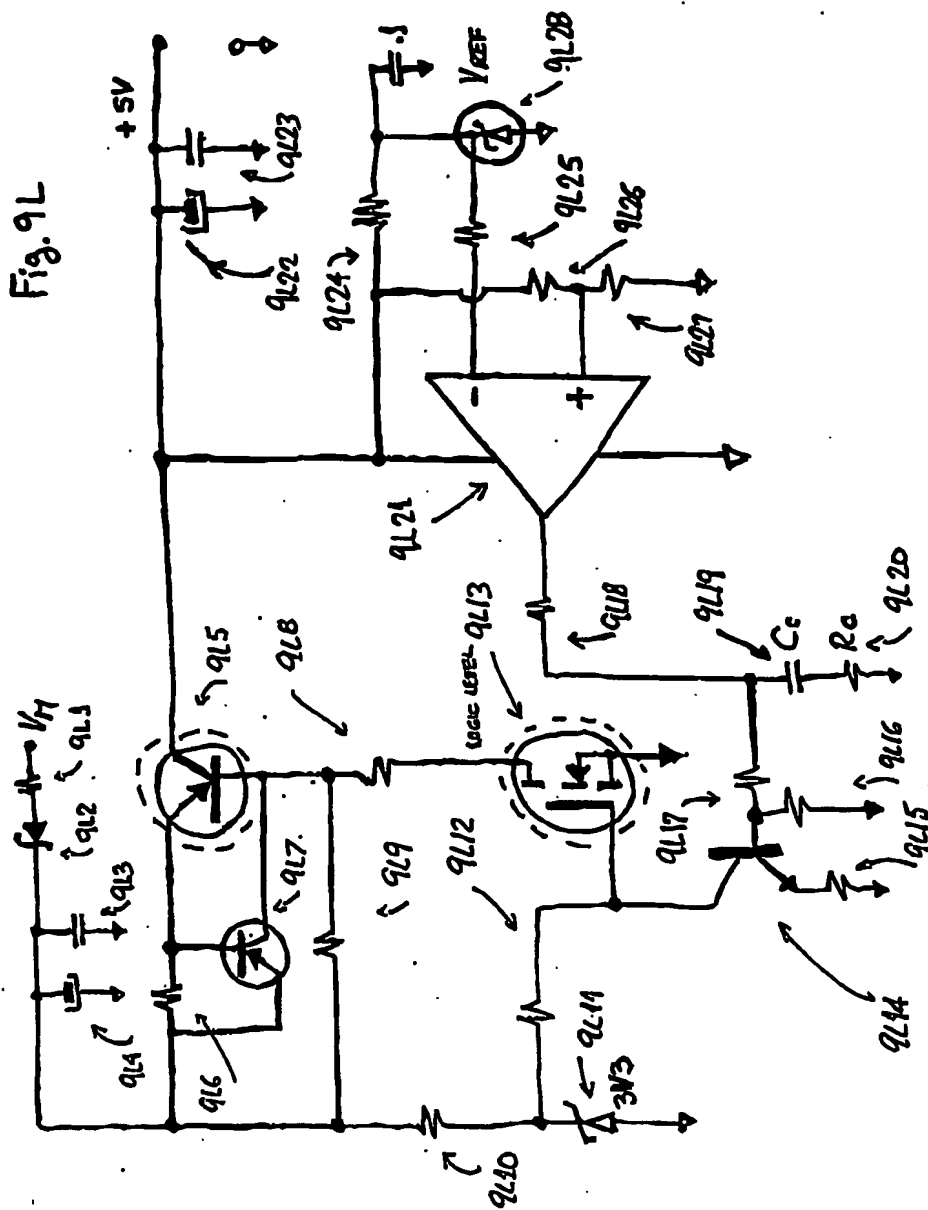
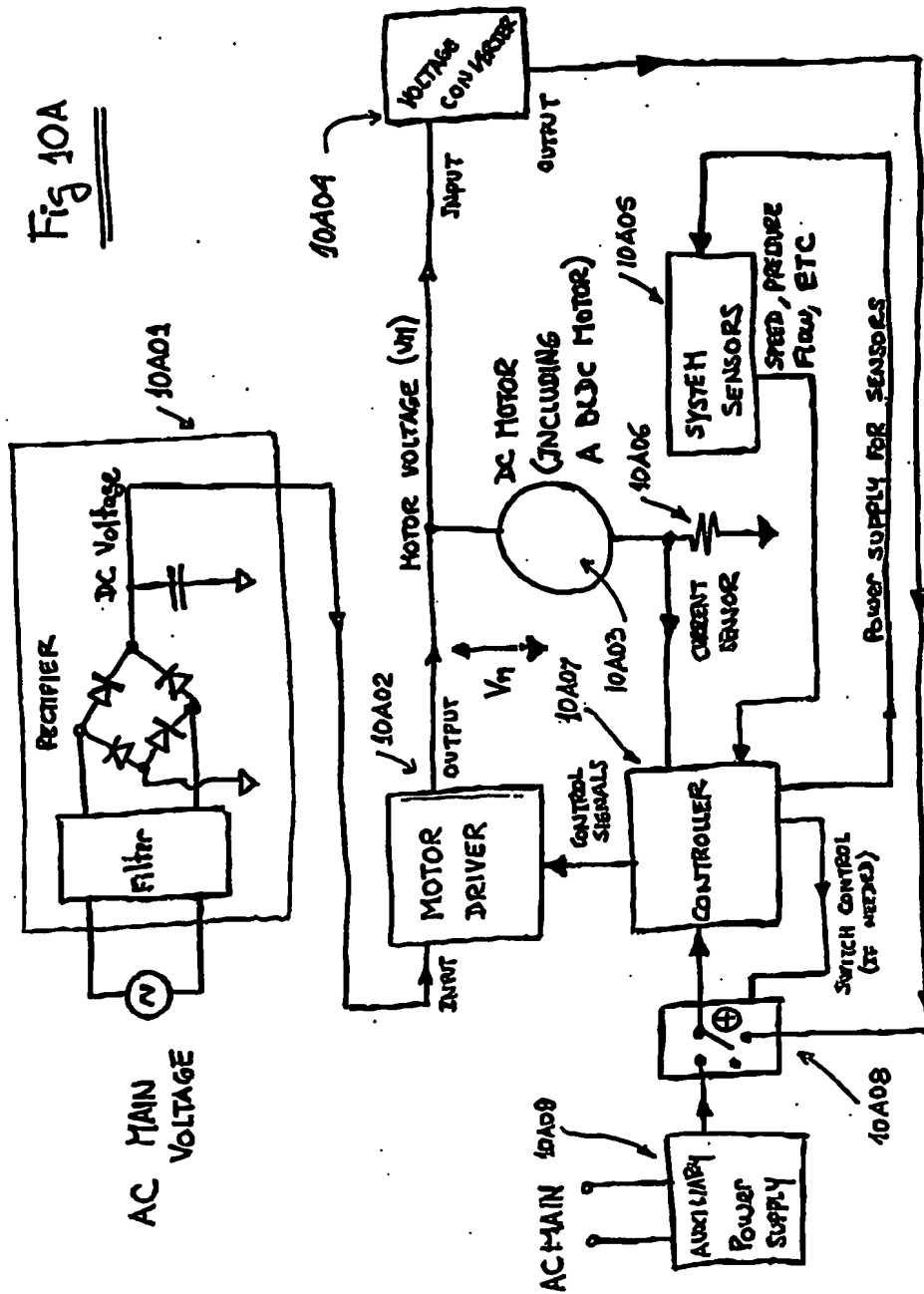
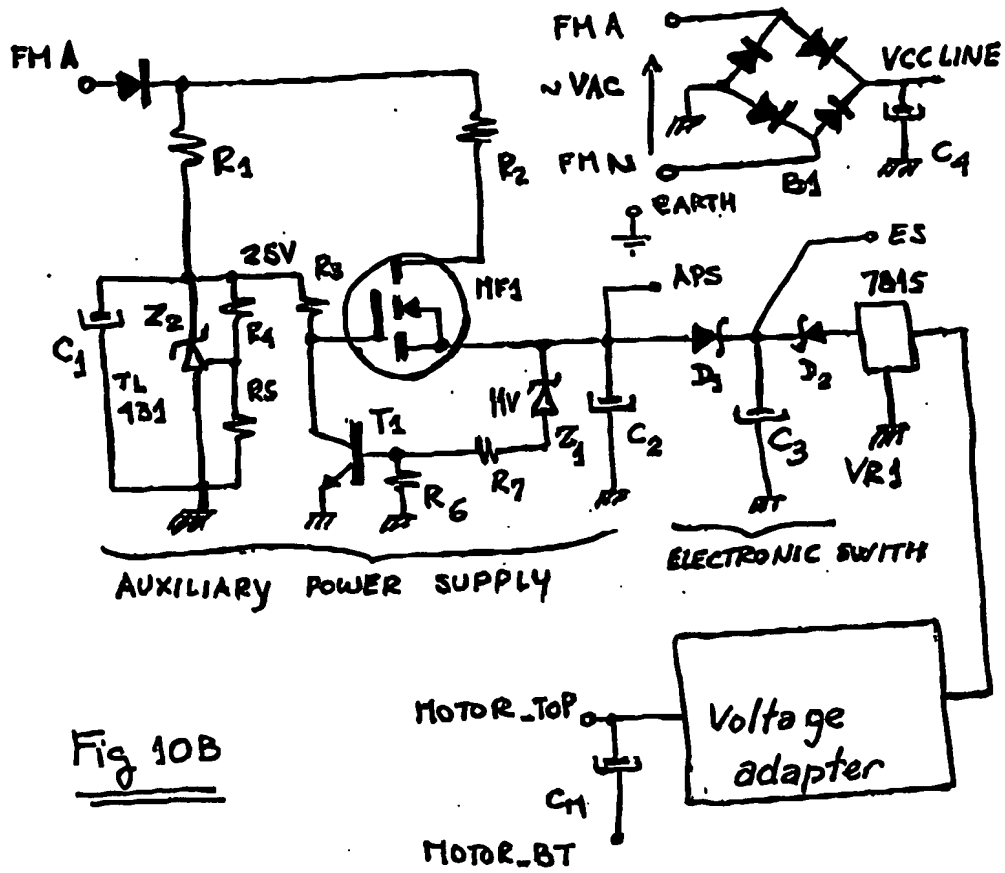
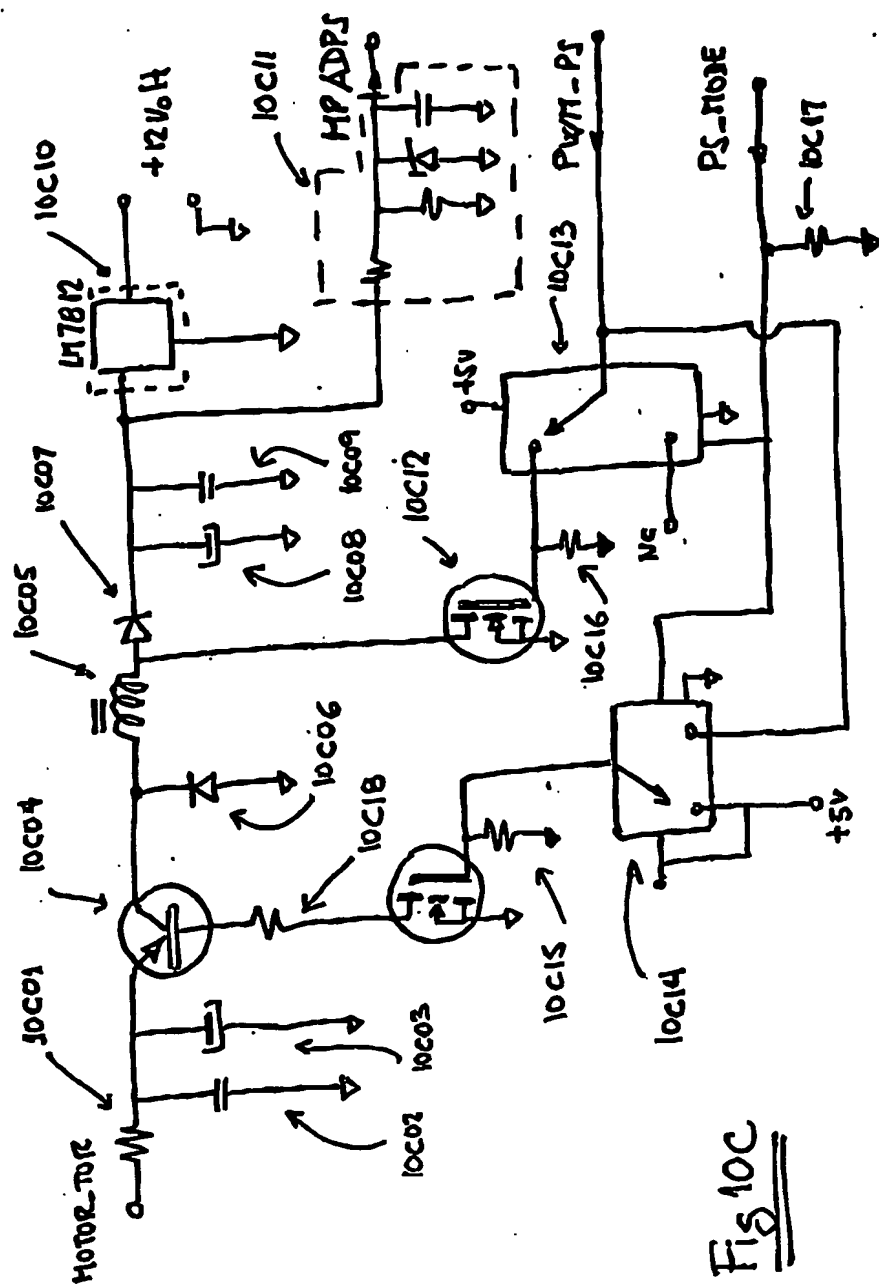
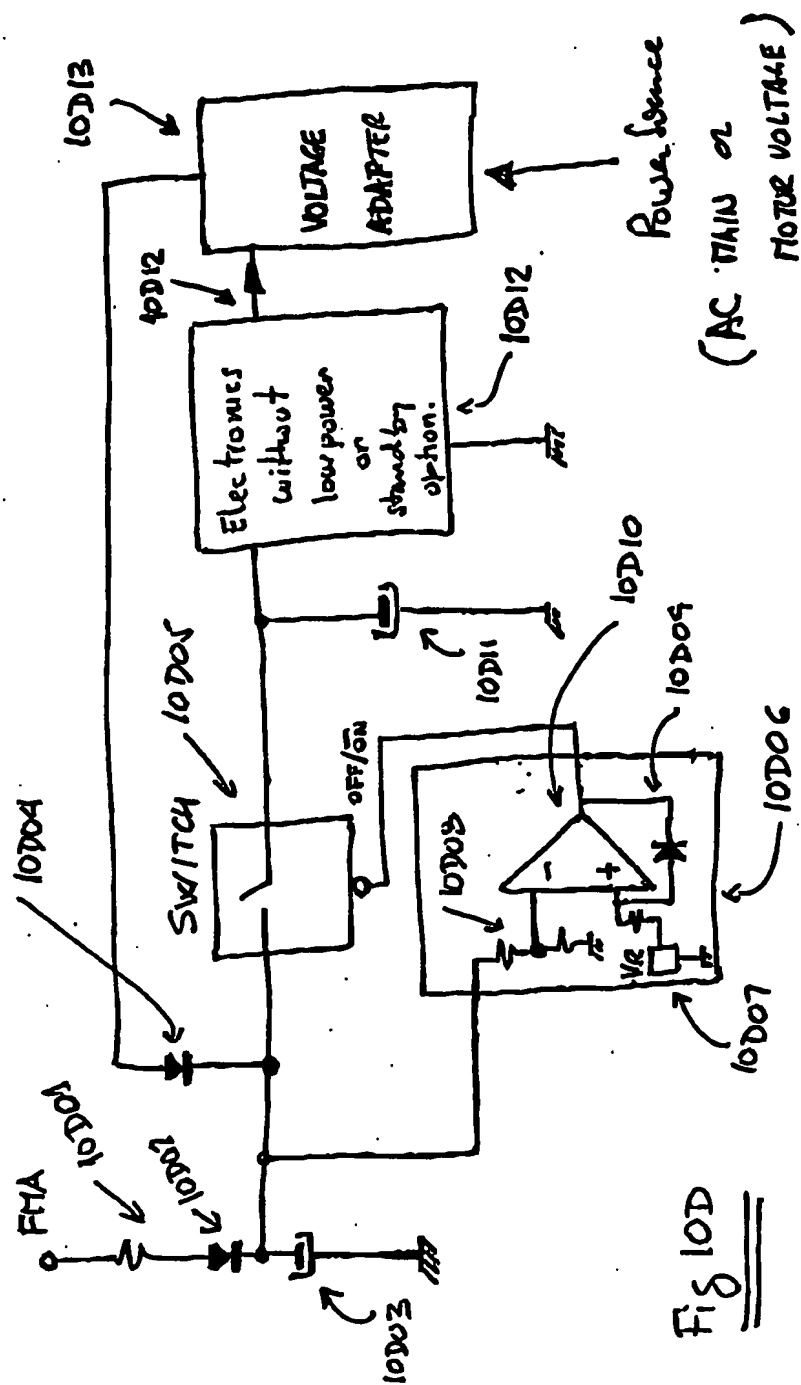


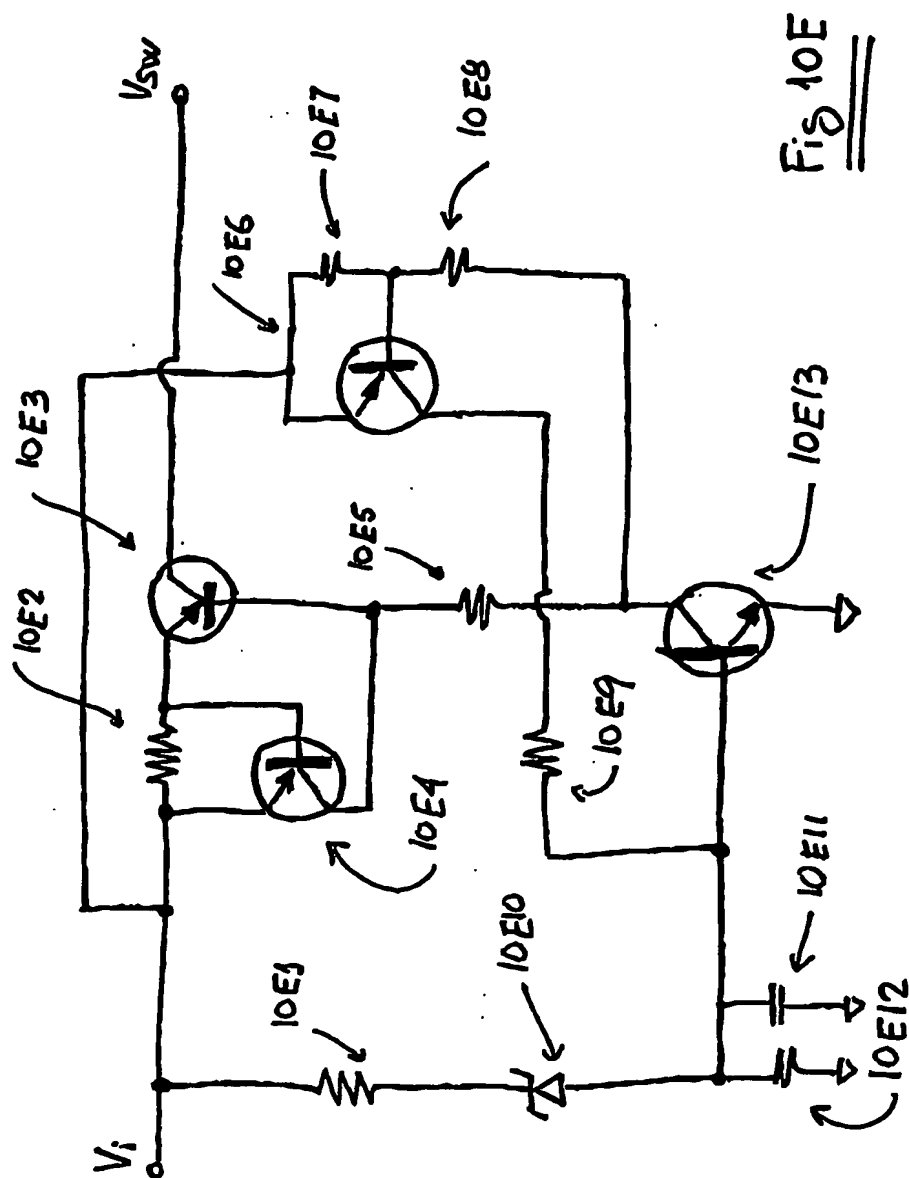
Fig 10A

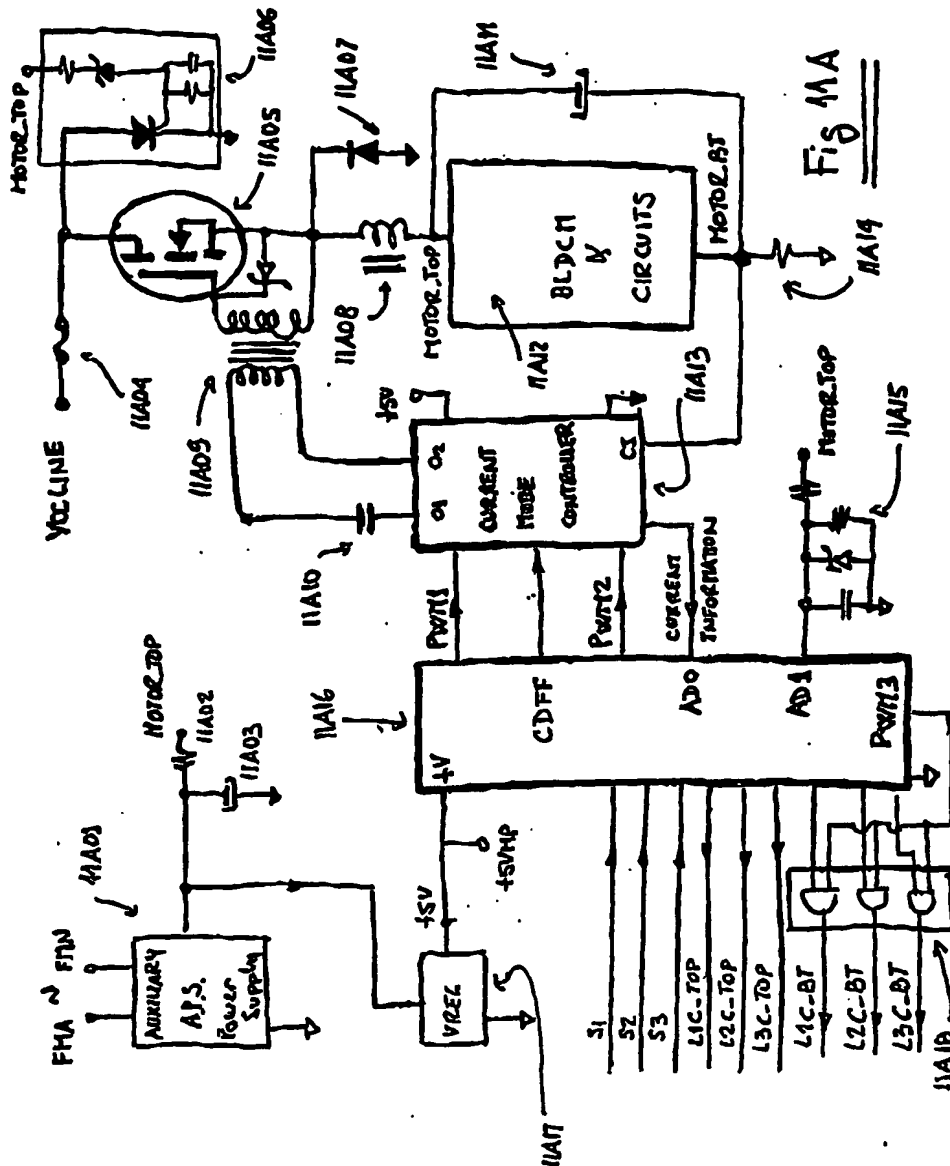


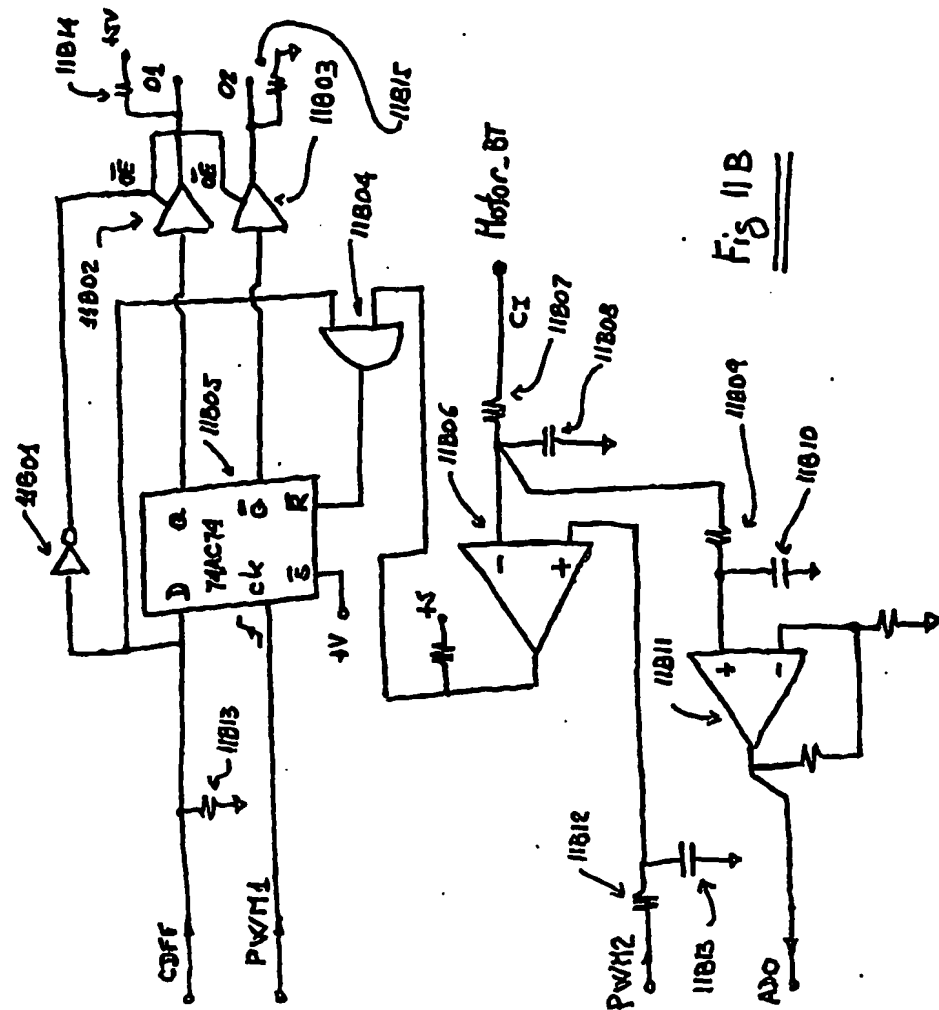


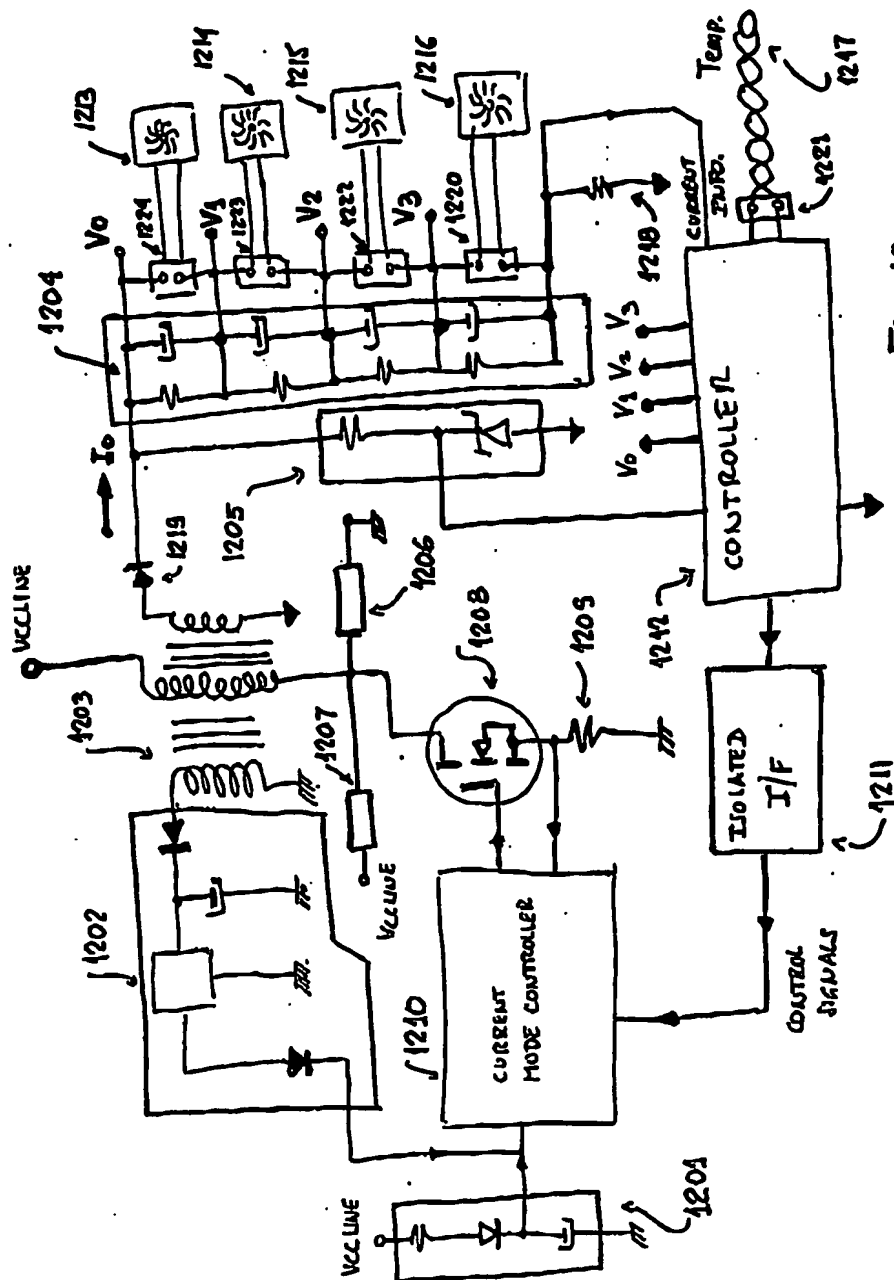












**Fig 12**



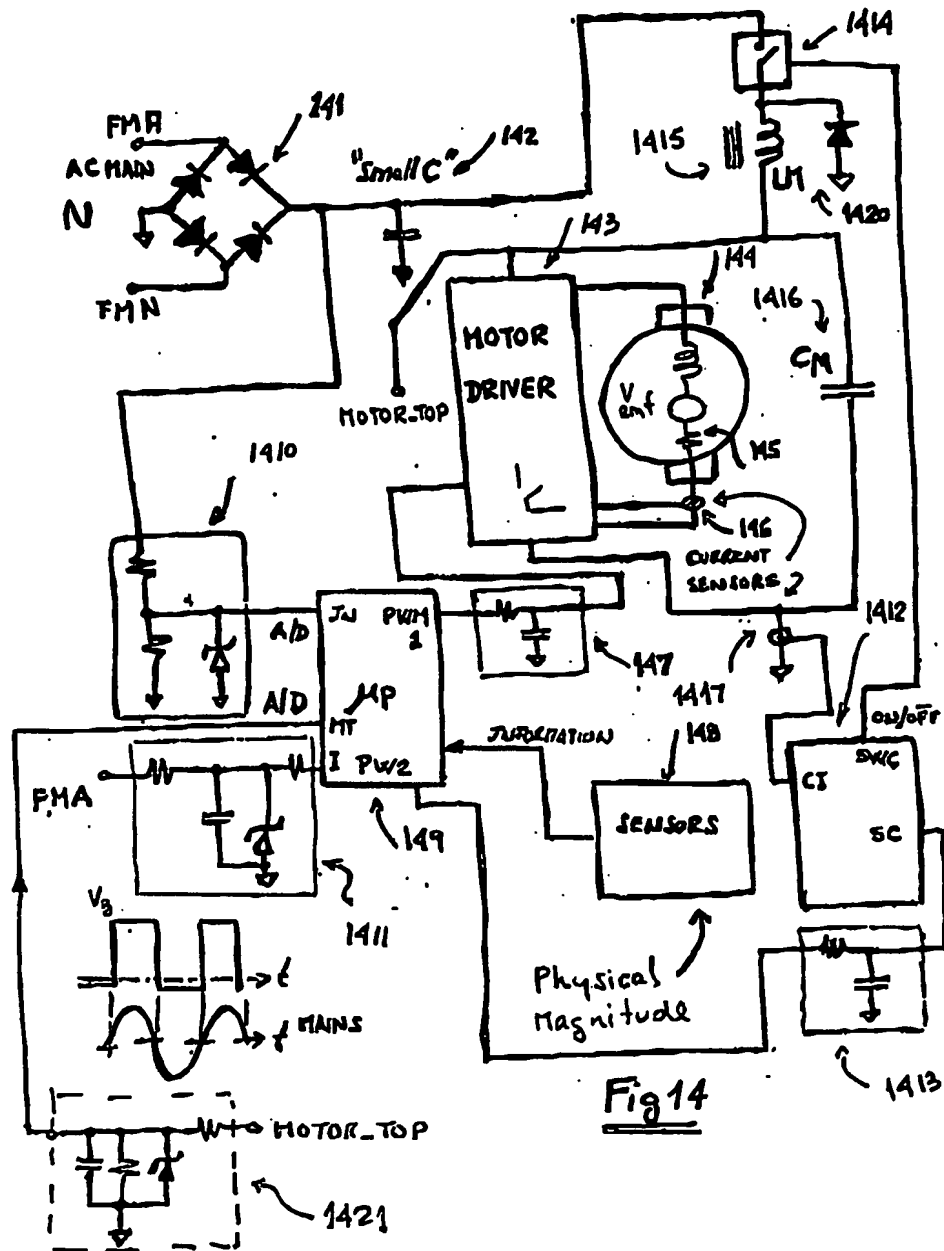
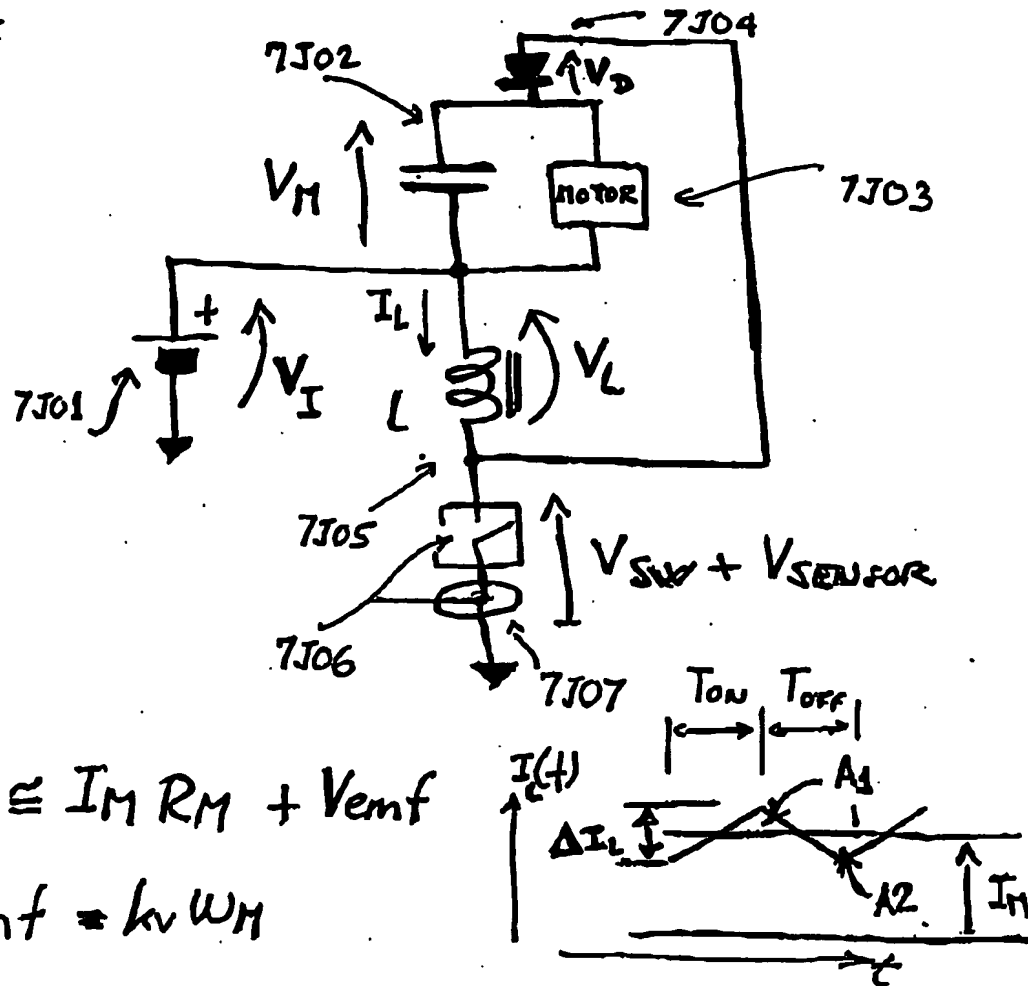


Fig 15

$$(1501) \quad V_M \cong I_M R_M + V_{emf}$$

$$(1502) \quad V_{emf} = k_v \omega_M$$

$$\left\{ \begin{array}{l} V_{SW} + V_{SENSOR} \ll V_L \quad (1503) \\ V_D \ll V_M \quad (1504) \end{array} \right.$$

$$\Rightarrow \quad \Delta I_L = \frac{V_I}{L_M} T_{ON} = \frac{V_M}{L_M} T_{OFF} \quad (1505)$$

$$(1506) \quad \frac{T_{ON}}{T_{OFF}} = \frac{V_M}{V_I} \quad (\text{For continuous conduction mode})$$

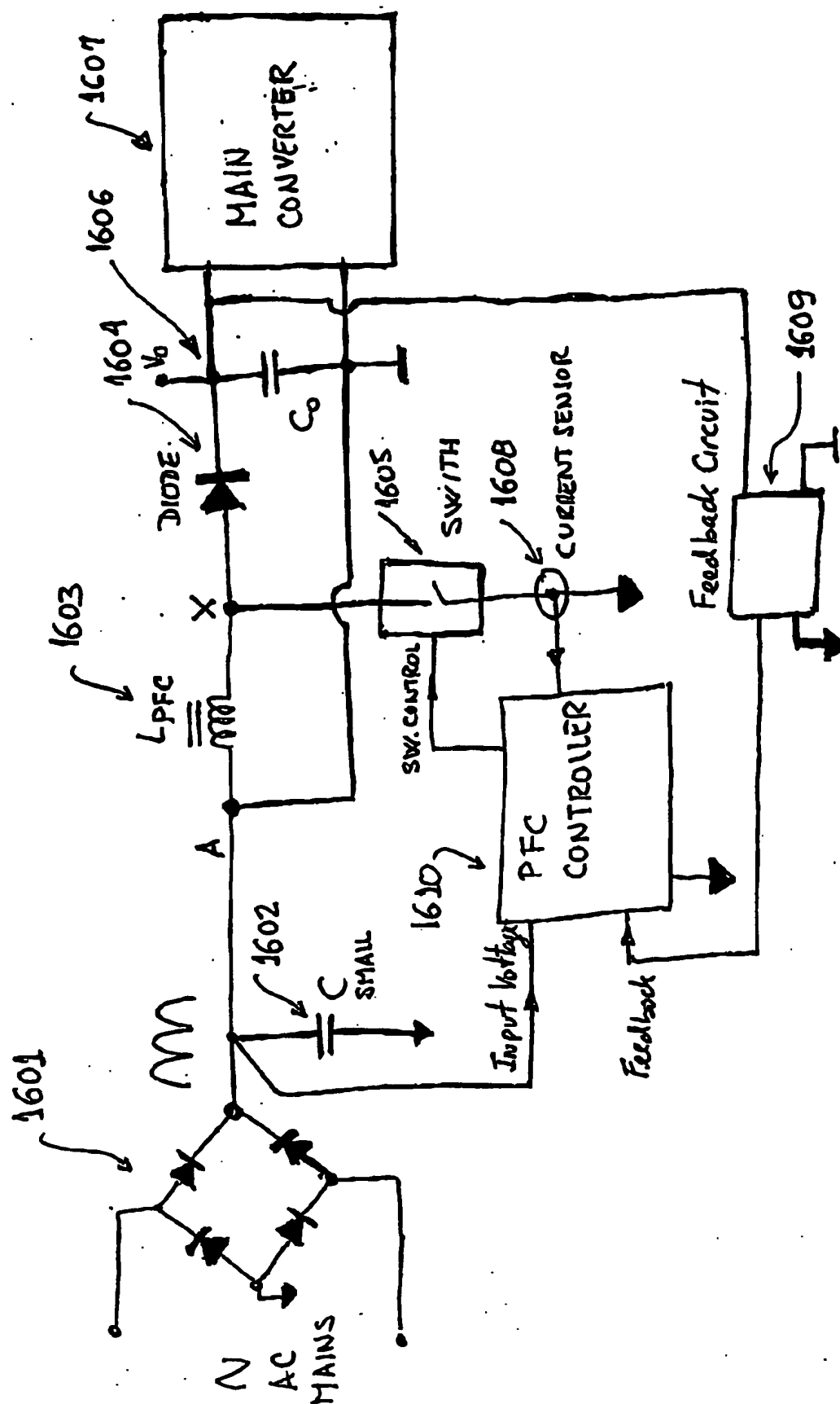
Fig 16

Fig 17A

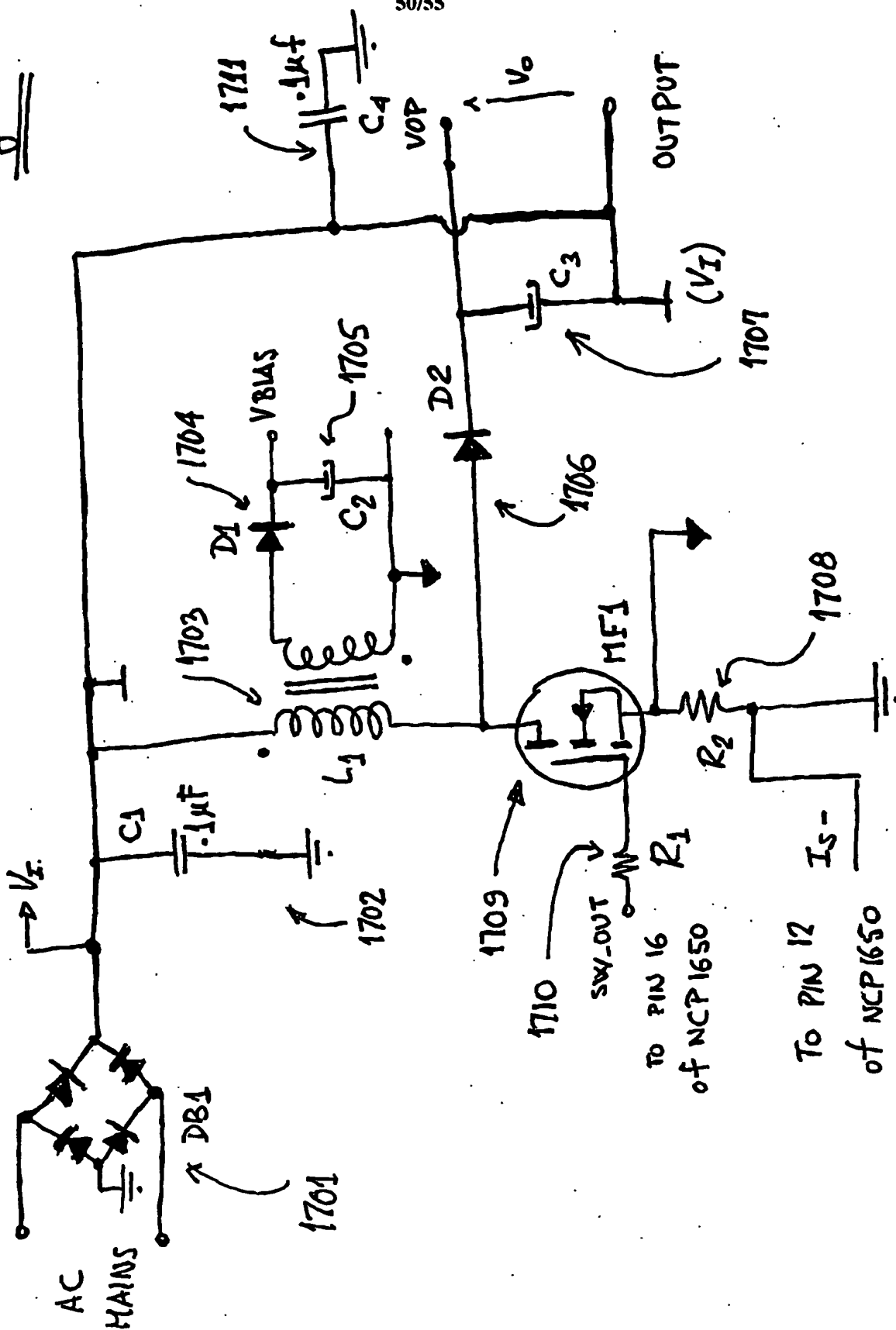


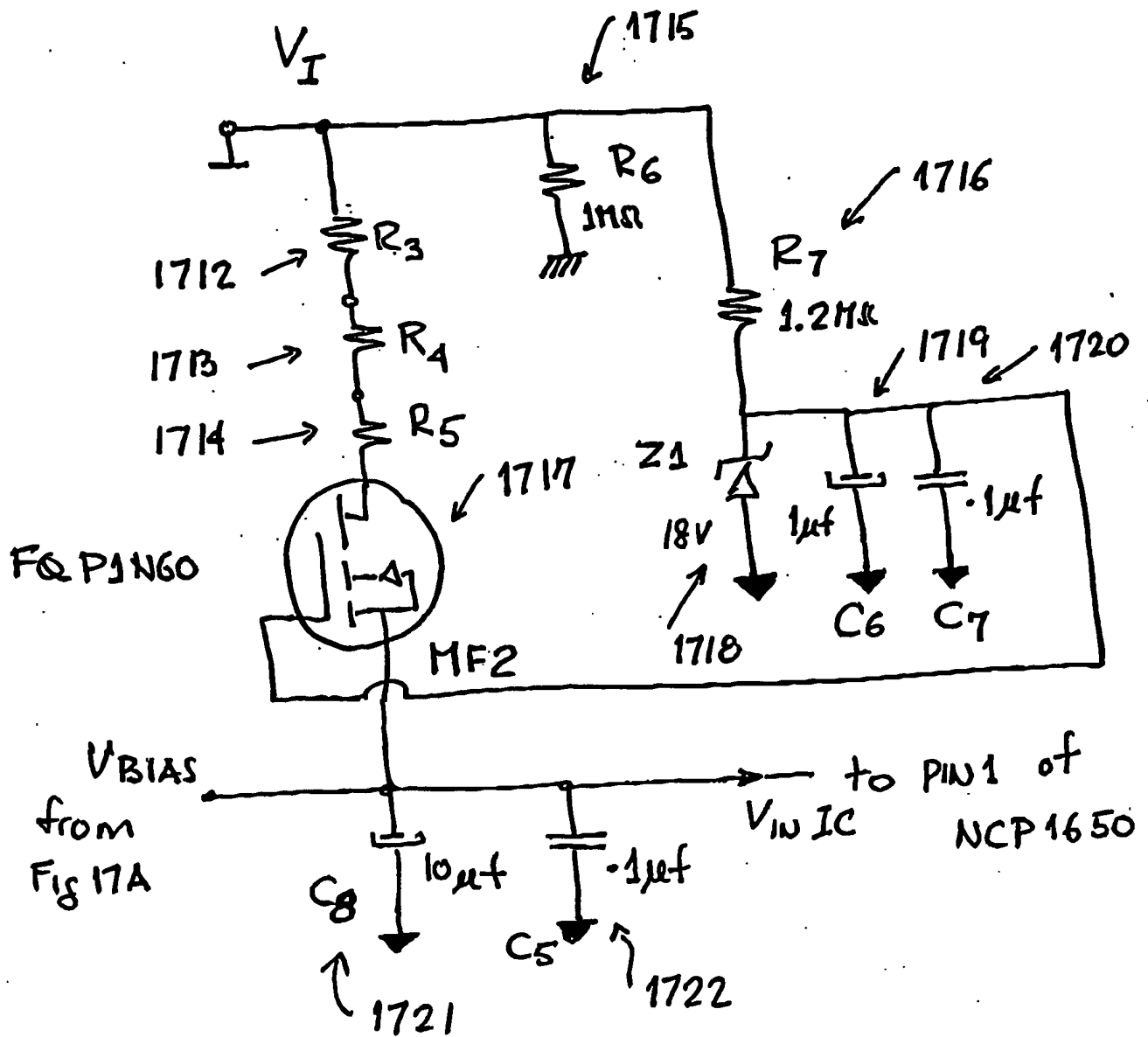
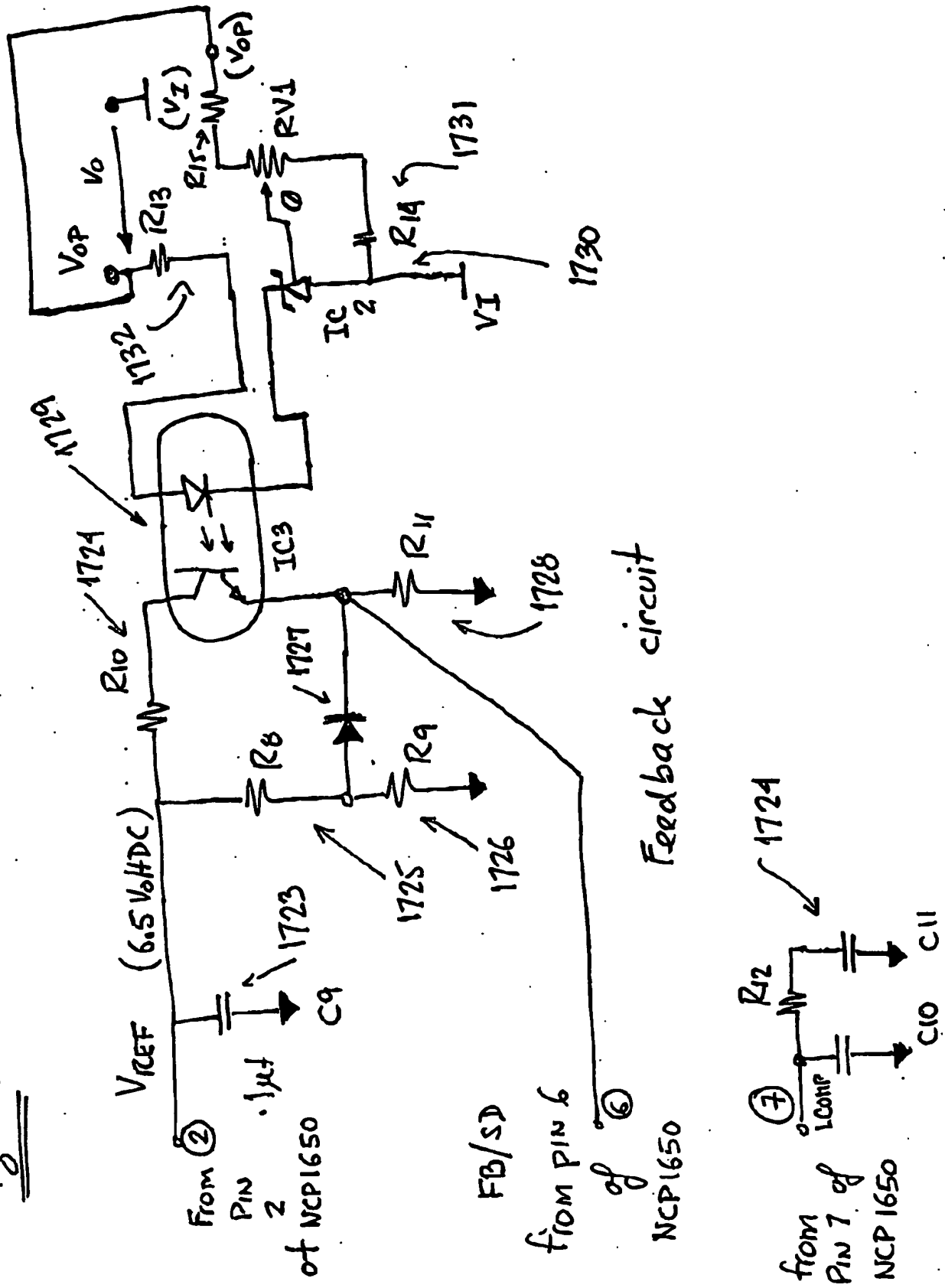
Fig 17B

Fig 17C



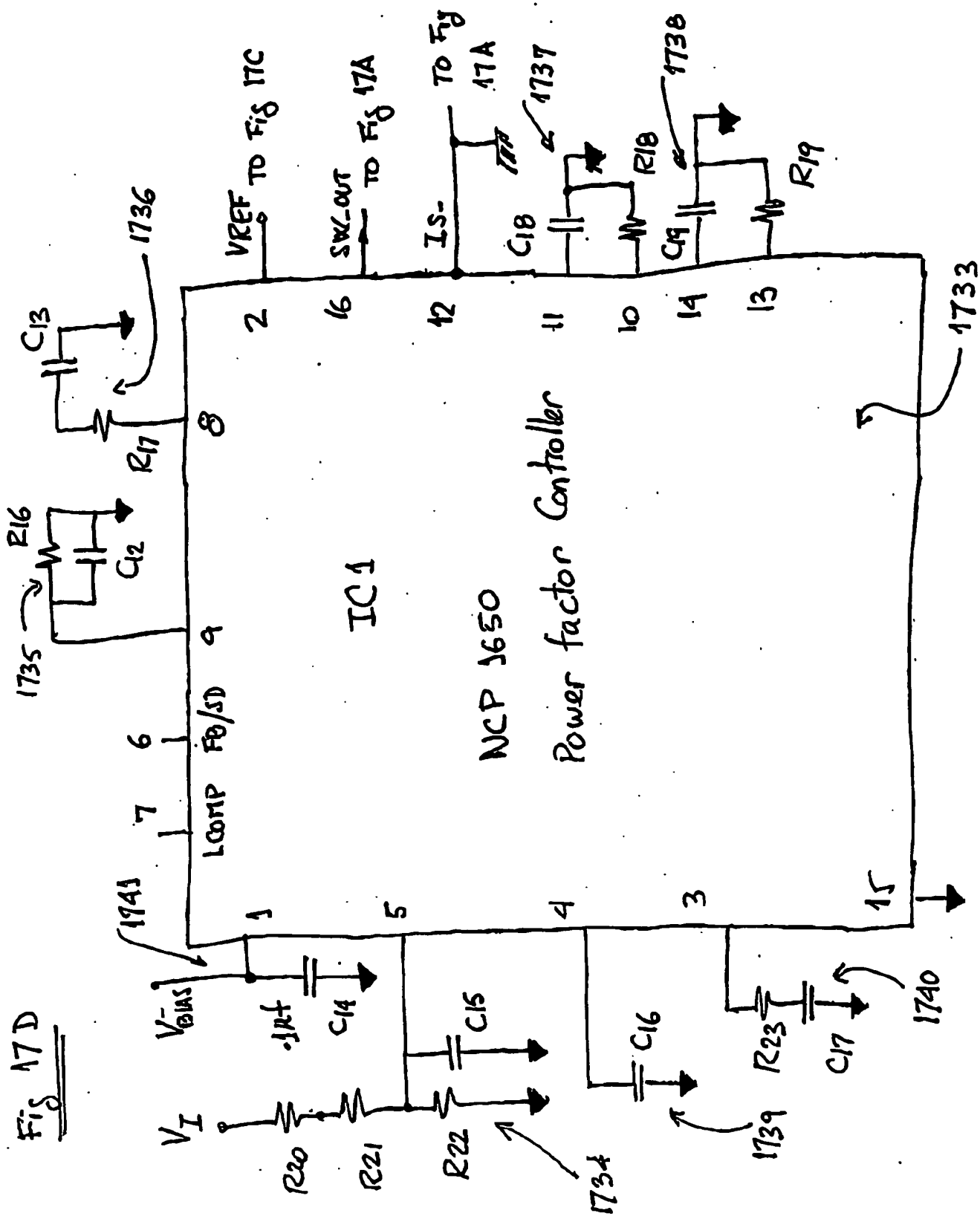
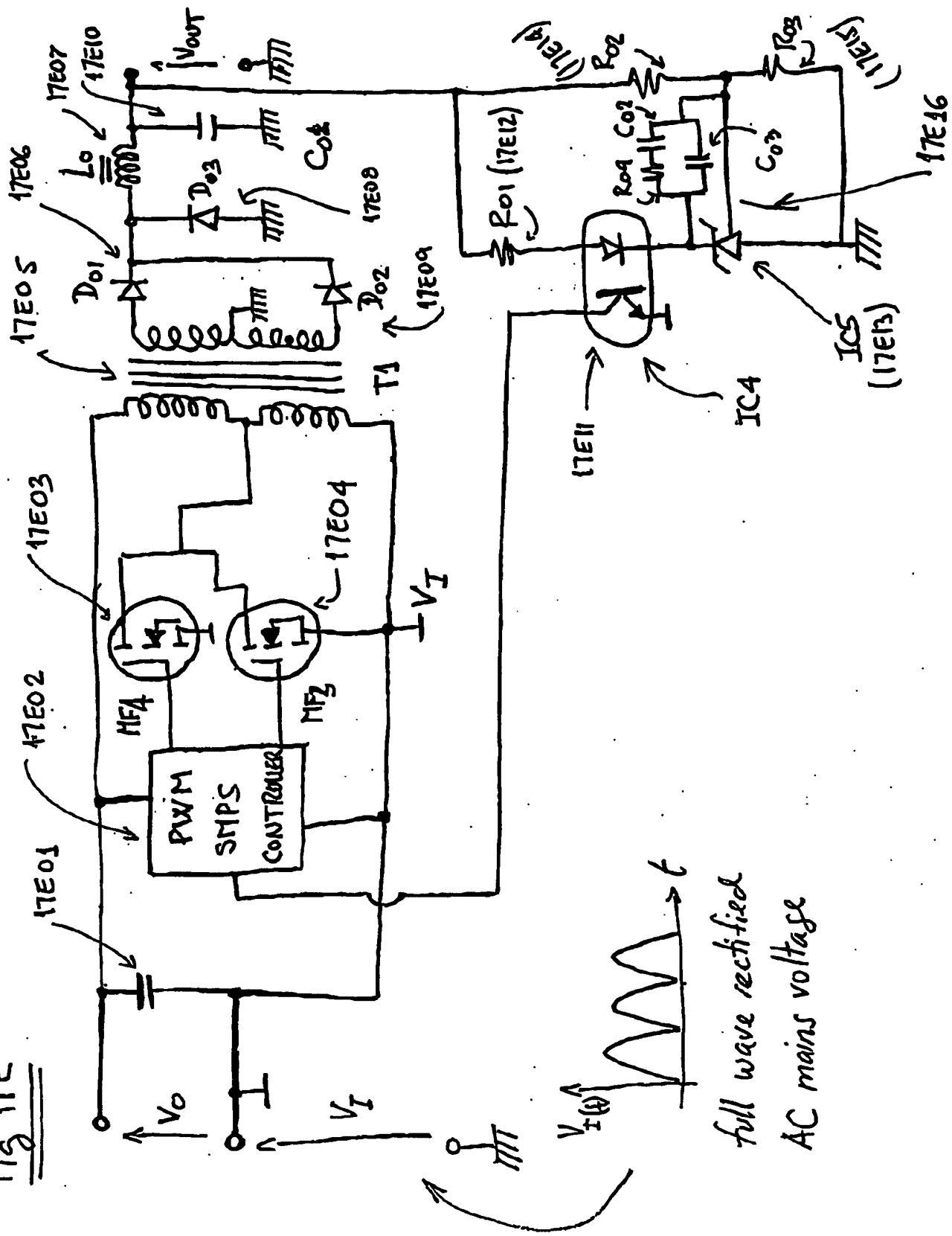


Fig 17E





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